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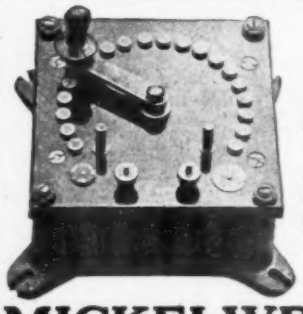
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The

Electrical Review

VOL. XCVI. APRIL 10, 1925. No. 2,472.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E. A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT., LONDON," Code, A B C. Telephone Nos.: Central 8240 and 8241.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

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Contractors v. Wholesalers.

IN a booklet issued a few weeks ago by the Electrical Wholesalers' Federation, and mentioned briefly in our pages at the time, that organisation published particulars of its Trading Policy. It was not claimed by the organisation that there was anything fundamentally new in the policy therein elaborated, nor was there any departure from the precepts and principles that had always governed its action, but publicity was given to that policy for the first time since the Federation began its operations in 1914, in the hope that it would carry the matter of fair trading for and between all sections of the industry a step further forward. If to arouse controversy is to help toward that desirable advance, then the propaganda movement has begun to succeed.

We did not reprint the Federation's declaration because it did not claim to be new, but as it is now torn to shreds with some "vigour" in the April issue of the *Electrical Contractor*, the official organ of the Electrical Contractors' Association, the subject probably merits fuller attention here. The declaration opened by explaining that the wording was purposely left "elastic" so that as time passed and new methods were required, it might be "possible to adopt them without infringing our principles." Our contemporary's article is described as a "critical survey," and while it is "communicated" and credited to a "correspondent," it receives the Association's official approval in editorial comments in the same issue. The publication of the statement is considered to have wrought evil already, while the word "dangerous" is used unsparingly.

The writer compares the respective policies of the E.C.A. and the E.W.F., and these contain different definitions of an electrical contractor—the E.C.A. defining him as a registered contractor, a member of the I.E.E., or a member of the E.C.A., while the E.W.F. recognises as an electrical contractor anybody with "business premises (and equipment) who installs electrical apparatus and/or sells direct to the public." This is advanced as the first clear illustration of the fundamental difference between the two policies. The E.W.F. definition is "so loose and ill-defined as to be practically valueless if not positively dangerous." The writer asks who was responsible for the E.W.F. document, and fails to find a satisfactory answer in the Federation's declaration. Is it clear why this information is so necessary, seeing that the Federation plainly states that it was prepared by its "Council"? The

writer also criticises the "very elastic" definitions of a wholesaler, the declaration describing him in one place as anybody who purchases and carries reasonable stocks for supplying the trade, and in another one who carries "adequate" stocks, the said wholesaler being required to "support the manufacturer by quantity buying where possible." The "Correspondent" searches the E.W.F. policy in vain for any definite recognition of the abuses that are rife in the electrical "wholesale" trade where anybody may pose as a factor and make a living by touting for and obtaining "so-called trade orders" on a basis of not more than £50 per week. The *Electrical Contractor* writer describes such men as "parasites on the industry." They carry no stocks worthy of the name, and their capacity for quantity buying simply does not exist, and in other ways "the ultimate effect" of their activities is to impose further burdens on both manufacturers and contractors.

There is a good deal more in the article. Fault is found with the E.W.F. definition of a trade user, and the real meaning of the word "service" is discussed. The document is considered of "very doubtful utility" and, in the opinion of the writer, uses "loose phraseology" throughout. It is interesting, in view of the foregoing, to note that the writer is careful to explain that no attack on the E.W.F. is either intended or implied. It is merely its "policy" that he attacks. Yet there are cases where a Federation and the policy for which it stands mean practically the same thing. The editorial comment leaves little doubt that the E.C.A. and the E.W.F. have some very different ideas, for it passes on somebody else's suggestion that the E.W.F. policy "should be officially withdrawn and re-issued at a later date after mature reflection has been devoted to its several clauses."

The existence of the differences between contractors and wholesalers is a perfectly legitimate subject for discussion. The E.W.F. declaration was designedly "elastic" in its wording so as to be adjustable to altered circumstances. Judging from the article before us, the two associations would do well to give more thought to ideas of co-operative action. Everybody has to recognise that the industry is composed of a variety of different interests. No one section can expect to dominate the rest, but conference may be a way to compromise even in such a matter as declaration of policy.

In fairness to the wholesalers, we quote paragraph 14 of their policy:—"The E.W.F. recommend joint action by all Sections of the Trade, and favour the formation of a joint council, which should establish rules to regulate the relations between each of the Trade Sections."

Tramways and Omnibuses.

The track of a tramway authority appears to be no smoother than the path of true love: whilst in London omnibus competition up to the present has been unrestricted—to the discomfort of the County Council—in the provinces the control with which the municipalities have hitherto been vested is being stripped from them by the Ministry of Transport; moreover, in many cases, they are not even permitted to run motor omnibuses in conjunction with their tramway services. Not long ago Bradford Corporation refused the application of a Wakefield company to operate a 'bus service in the city, but the Minister of Transport over-ruled this decision, and it appears that in this respect his powers are absolute. Clauses in Bills promoted by the Corporations of Leeds and Bolton, empowering them to run auxiliary motor 'bus services outside the borough boundaries (with the permission of the adjoining local authorities), were struck out by Parliamentary Committees on March 18th, and the matter was brought to a head in the following week when a meeting of representatives of tramway authorities, convened by the Municipal Tramway Association, was held in London. A resolution that local authorities should have freedom to operate motor-'bus services on the same basis as private owners, and that appeals to the High Court against refusals of licensing authorities to license motor-'buses should be restored, was unanimously adopted, and it was decided to approach Members of Parliament and the Prime Minister on the subject.

It is singular that the dice should always be loaded against the electric tramway. Carrying the burdens bequeathed to it by the old horse tramway, and saddled with additional loads which even the latter escaped, it is exposed by the Government to the promiscuous competition of uncontrolled motor-omnibuses, whilst it is not allowed to use 'buses as feeders to its own services; and then it is abused and declared to be obsolete by the omniscient lay Press, because thus handicapped it cannot work at a profit! Moreover, in London the competing omnibuses themselves show a heavy loss, proving that even under such unfair and one-sided conditions they cannot beat the tramways without a subsidy. It is high time the tramway authorities were relieved of their burdens and permitted to show what they could do in fair fight. They would run the omnibuses off the road in six months.

The climax of misrepresentation was reached when the *Daily Mail* referred to the London tramways as subventioned by the motor-'buses, and said: "This means intolerable injustice!"

That differences of opinion should exist is natural and reasonable; but here we are dealing with facts, as disclosed by the accounts of the tramway and omnibus undertakings, the accuracy of which is not questioned, and anyone who investigates those facts in good faith must inevitably agree that they are exactly the reverse of what the *Mail* would have its readers believe. Last year the tramways relieved the London rates of a sum of £337,500, which would have had to be paid even if there had been no tramways; and most of this was spent in maintaining the roads used by the motor-omnibuses in competition with the tramcars—truly an "intolerable injustice!"

A Compensatory Load.

While the domestic demand is frequently referred to as "the load of the future," there have been recent instances in which it has proved a present help in time of trouble. For one of these we may refer to the speech which Mr. R. P. Sloan delivered at the recent annual meeting of the Newcastle-upon-Tyne Electric Supply Co. Mr. Sloan pointed out that the industries of the North-East Coast remained in a very depressed state during 1924, and yet the company made nearly 30,000 h.p. of new connections, and the demand continued to grow. This was due, he said, to the remarkable growth of the domestic demand which the company was further stimulating by a "residential tariff."

A recent article in the *Electrical World* indicates that this fortunate accession of domestic demands coincident with the lower requirements of a depressed industry is not confined to this country. The Narragansett Electric Lighting Co. had an output last year 23 per cent. below that of 1923, and yet there was a substantial increase in the net earnings. The reason for this was that while the company was called upon to supply a far smaller amount of low-priced energy to the industries in its area, the domestic demand, carefully fostered by the company for rather higher-priced energy, compensated for the loss.

Commenting upon this, our contemporary says:—"It takes a lot of flat-irons and washing machines, vacuum cleaners, and even electric ranges and refrigerators to offset a decrease of eighty-one millions in kilowatt-hours generated, but in this case it was worth the effort. The Narragansett Electric Lighting Co., in the midst of an industrial slump, was able to show a substantial increase both in gross and net earnings because some years ago the possibilities of the small customer and his diversity of demand were correctly appraised, and a definite sales policy was laid down and followed out."

These are examples of many such cases which have occurred during the past year or two, and while we consider that the domestic demand should be cultivated for its own sake, we think that it might also be regarded in industrial centres, which are liable to periods of depression, at least as a compensatory load.

Delivery and Price.

Without detracting in the least from all that has been said about the vital influence of cost of production upon our ability to compete successfully in overseas markets, it is as well to point out that early delivery is sometimes of greater consequence than low price. High price and slow delivery may both follow directly from the lack of a proper atmosphere in the factory, but happily in a number of recent contracts for the Indian Government, British manufacturers, though unable to quote as low as Continental firms, have been able to give better delivery, and as that was of some importance, they have been successful at higher prices in consequence. The greater cost of inspection over long periods, the earning power of the product through getting into service quickly, the time absorbed by foreigners in making new patterns—these are all considerations which count with those who have to weigh up the respective merits of competing offers.

The placing of Indian Government stores contracts is watched with a jealous eye by some members of the Indian Legislature with the determination to prevent preference being given to British manufacturers, and when the matter was forward recently, Sir B. N. Nitra (according to *The Times Trade Supplement*) stated that stores were being obtained in accordance with the policy of purchase in the cheapest market, "subject to quality, delivery, and other necessary conditions." Our contemporary sets forth the circumstances attending a number of contracts, where competition was international, for wagons, girder bridges, and axle boxes. The writer remarks that we can only hope to retain this asset of early delivery ability if we can secure a reasonable prospect of industrial peace in the trades concerned. In the deliberations that are in progress between the employers and unions connected with the engineering industry, this important aspect of industrial relations requires to be kept well in view.

Our contemporary, the *Engineer*, states that when the two committees, suggested by the Ministry of Labour, met on March 31st their conference lasted for 6½ hours and then adjourned, leaving matters in a delicate state. The inference is that the employers' representatives adhere to their desire to consider together the wages question and the question of workshop conditions, whereas the unions' representatives persist in treating the two matters separately. After Easter a full conference of all the unions may be summoned.

One other thought which arises from the discussion in the Indian Legislature is the harmful effect which our own comparisons of British and foreign competitive prices may have upon the mind of buyers overseas. In seeking to impress the mind of the worker at Home with the serious position of our industries, we produce telling comparative figures. Unfortunately, these figures may be used to our detriment abroad by those who are anxious to prove that we are so high-priced as to be out of the running.

British Employment First.

Local authorities in England and Wales received a document from the Ministry of Health recently urging them to ensure that in contracts placed by them as large a use as possible should be made of materials of Empire production. The principle was included, or we ought to say reaffirmed, in a resolution passed at the Imperial Economic Conference in 1923, and State, provincial, and Local Government authorities were then desired to adopt it. The communication that has just been issued adds the important appeal that such a course should be subject to the condition that the policy laid down in a previous circular stressing the necessity for placing contracts in this country should not be departed from. The present special circumstances with regard to unemployment cannot be ignored, and home production is a matter of even greater urgency and desirability than that of the use of Empire materials. There are still nearly a million and a quarter of our people unemployed, and the signs and reports of world trade improvement have during the past few weeks alternated with very depressing statements from the general engineering and shipbuilding trades, such as those relating to the closing of the Richardsons-Westgarth works at Middlesbrough, the passing of the final dividend on Beardmore's preference shares, and the inability of Arrol's to pay the preference dividend due at March 31st. Most assuredly the Ministry of Health could not have chosen a more important moment for the issue of its reminder how imperative it is for the needs of British workmen to receive first consideration from every municipality that has engineering contracts at its disposal.

The Future of the Telephone.

In reply to a question lately put to him in the House of Commons, the Postmaster-General said that there were eleven countries in advance of Great Britain in the matter of telephone development. The information was not new, but the question served to keep up interest in the matter, an interest which is being assiduously fostered by the Telephone Development Association.

As is the case with other applications of electricity, the British public simply does not realise fully what the telephone is and how it can be utilised for the saving of time and trouble. Even to-day the telephone is shrouded in mystery for a large body of the public, while many business men only use it grudgingly. Education will change all this, and there are signs of an awakening due to the prominence which has been given to the matter in recent months.

The chairman of the British L. M. Ericsson Manufacturing Co., Ltd., proved that his company had faith in the future of the telephone when he stated at the recent annual meeting that the company's works had been considerably extended to meet the anticipated demand. As an indication of what that demand might be, he said that to put this country on a par with Denmark in respect of telephone development, about 3,000,000 telephone stations would have to be installed, and £150,000,000 expended. To reach the standard which exists in North America, he said, these figures would have to be multiplied several times. This reiterated comparison with other countries is apt to become monotonous, but if it leads to an effort to get abreast of our rivals it will be justified eventually.

However, whilst we lament the apathy of the public as users of the telephone, we may derive some consolation from the zeal and ability displayed by the technical staff in developing the system. We recently referred to the excellent work of the Post Office Engineering Department in connection with the extension of automatic telephony, and now we have to compliment the Department on its enterprising experiments in pursuance of the proposal put forward by Mr. Frank Gill in his presidential address to the I.E.E. two years ago —that all Europe should be treated as one area for telephonic purposes. According to the *Morning Post* of April 7th, successful tests have been made between London and Stockholm, Turin, and Berlin, conversation being established in each case. Local improvements have been suggested by the British Post Office staff, and further tests are to be made in a week or two between London and Stockholm, after which a regular (night) service may be commenced.

Here again we are indebted to the thermionic valve, as an ideal telephonic repeater, and therefore to Dr. J. A. Fleming, for a remarkable advance in international communications, which may have far-reaching effects on the future not only of the telephone, but of civilisation itself.

In Memory of Six Workers in the Electrical Industry.

By J. S. HIGHFIELD.

This year has seen the passing of several men who spent their lives helping to make electricity a useful servant of man; they were all notable in their several ways and all very useful, and they earned the regard of their fellow workers. By their friends they were admired and respected, and as I had the great pleasure and privilege of knowing them as friends, I write a few lines to try to record their virtues. They are Oliver Heaviside, C. H. Wordingham, W. L. Madgen, Walter Markby, W. Mosse Robinson, and Wm. Stagg.

Oliver Heaviside

I knew first in 1921, when I was President of the Institution of Electrical Engineers. The Council desired by some special mark to celebrate the 50th year of the Institution's foundation. Amongst other things, the Faraday Medal of the Institution of Electrical Engineers was created, and it was awarded first to Oliver Heaviside; it was in fact partly the desire to praise his work that led to its foundation and there could be no worthier motive. It is so easy to forget unforgettable service when performed by one who chooses to live a life quite remote from his fellows, who from the Olympian heights of a most gifted mind, uses an impish pen to write disparagingly of Authority and who flouts all the honours which most men desire and some men seek.

It was my duty as President to present the Medal, and the duty was an interesting and pathetic one. Heaviside lived entirely alone in a pleasant house in Torquay—a house decaying from long neglect. I called first by appointment and found him waiting in the weed-covered drive in an old dressing gown, armed with a broom and trying rather vainly to sweep up the fallen leaf. He was pleased to see me in a queer shy way, and took me through a furniture laden hall, all covered with dust, to his own room. He had papered the walls with prints and reproductions from many publications, and pointed out to me old Presidents of the Institution of Electrical Engineers and all the recent ones, and asked me about them. The walls held a pictorial record of his life's interests. He was in all ways entirely competent, and still preserved his power of impish criticism. Often he was amusing in a caustic way; he was intensely interested in my account of the commemoration ceremonies, and genuinely pleased that he had been recognised at those meetings as one of our famous men. His way of life made a pathetic background to his mental activity, but I am sure he did not regard it as pathetic. He talked freely of all recent work and development, but his talk was interfered with by many petty personal complaints of the most homely description. I saw him several times and tried to improve his menage, and especially his food supply, which was inadequate, but with little result. He was quite content to live as an old world hermit, and so indeed he lived.

I saw him again in the August of 1922, and again when I formally presented the Faraday Medal early in September. He seemed greatly improved in health, and there is no doubt that the interest taken and shown in him by his fellow workers of the Institution had really cheered him; in fact, he seemed quite happy. The presentation of the medal was interesting. He vigorously criticised the wasteful expense of the leather-covered vellum document which accompanies the medal, but was consoled by the medal being of bronze and not of gold. He read every word on both document and medal, and was especially pleased to see the name of Alexander Siemens, who signed as the oldest Past President. He talked much about telephony and wireless, all interspersed with homely grumbles at the many defects of his neighbours. He seemed to know all that went on in the town. It is impossible to give any adequate account of one who so despised what most men desire, but when I left him I felt that he was content, that he respected the Institution, and that it had pleased and made happy one of its famous men.

Charles Henry Wordingham.

I remember clearly the first time I met him in the Siemens Laboratory at King's College, about 1889. He was keenly interested in some research which we, as students, were carrying out for John Hopkinson; keen is the precise word; a slight dark alert figure, eagerly energetic and slightly annoying Ernest Wilson—our little and greatly beloved Professor—because he restlessly desired results which came, if at all, but slowly. Again I remember well when he showed me over the old Bloom Street Station in Manchester, where he had rigged up switchgear for balancing machines precisely on the old Siemens Laboratory lines, but with 2-lb jam jars for mercury cups, and they worked very well. He had strapped up circulating pipes with wood, pitch and wire. He filled the boilers to the highest and rather unsafe level before the load came on, and worked them down to the lowest and rather less safe level to carry the peak load. Such were the conditions under which electrical supply was perforce conducted in the early days, but the experience made men. Wordingham performed yeoman service for Manchester at a most critical time. He was a hasty but quite fearless engineer. He began standardising fittings in Manchester, and never lost interest in the subject, and later he worked hard to establish a proving house. Few men worked more energetically to help on standardisation; but he always worked eagerly. Again, I remember him at the first meeting in London of the Incorporated Municipal Electrical Association, in the work of which he bore so useful and distinguished a part. Everyone remembers his work as President of the Institution, when he added so much to others' interest in the Local Centres and gave birth to such schemes as the Electrical Development Association, the Society of Radiographers, the Electrical Research Association, and many others. He had a hard and difficult job at the Admiralty: his eager spirit was not exactly suited to work inside official grooves; he never understood that perhaps in a seafaring organisation, where conditions are exacting and where the *personnel* must be closely trained, grooves or guiding rails are essential.

Few men were more stricken by the war. At heart he was a man of peace, a believer in peaceful intention, and the deliberately schemed attack smote hard on all his ideals. He worked furiously during the war; he was equally eager afterwards to help the returned men in every way. He seemed inspired by a passionate desire to accomplish more, both during and after the war, than man can compass. Though many of his plans, so conceived, necessarily came to nought, his inspiration led to many things being done which, without his eager spirit, would never have been attempted. He was the kindest and most simple-hearted of men; true to his own high ideals, true to his friends, and a passionate worker for his country's welfare and honour.

William L. Madgen.

It was, I think, in the late autumn of 1895 that the Stafford Corporation's works were first started, and when there was to be an opening ceremony and preparations for this were afoot. I was the engineer under

my old friend the manager of the gas and electricity works, John Ferguson Bell. It was my first important job, and I was a very proud man as I surveyed three 60-kW engines and two men—my men. There arrived on the scene a pleasantly imposing personage in the shape of William Madgen. I remember to-day his tactful and sympathetic understanding of the importance of my position, and his kindly interest in my mistake of excluding forcibly from the works a person who seemed to me to be one of no importance, but turned out to be a member of the committee. I remember his skilful advice as to the proper steps to take to put matters right. All this at our first meeting. Then I remember how much I admired the insinuating smile with which he introduced the subject of the use of demand indicators and Ferranti meters, and the interesting way in which he described the beautiful intricacies of both.

If Heaviside provided the ideas, Madgen truly had a master mind for setting them to service. He clearly grasped the essential necessity of turning ideas to profit if they were ever to be of service to man. He had the clear vision to see that unless the electrical industry could pay its way, earn profits and so establish credit for itself, it never could grow. Development by money raised on the credit of rates did not please him. He saw clearly that such credit used for electricity supply was a wasting source, and that only on the growing credit of the business itself could real healthy progress be founded.

I learnt these things long after the Stafford days when I saw much of William Madgen. He was one of the first men to see the importance of creating undertakings which should supply in wide areas, and took a full hand in the foundation of the power companies, of several of which he was a director. The debt which the electrical industry truly owes to the founders of these companies has neither been recognised nor acknowledged, and of these men William Madgen was one of the first.

It was a grievous day when illness smote him. Long since he had been an athlete and a notable lacrosse player, but latterly he had failed, and then a severe illness claimed him, from which he never really recovered. He came to see me last November; it was a sad meeting for me to see one who had been so bright and bold and gay a mere shadow of his old self. But the shadow was true to type, and he told me brokenly of a scheme in the Empire at which he had worked and which he hoped I could follow up. The old instinct of development based on profit, the necessity of development if the Empire were to endure was pressed on me by an eager but sadly halting advocate. That was the last time I saw him, and he showed then, as always, the light touch which leads to laughter, which oils the dry wheels of mere business and makes smooth the way to great enterprise. As he talked I could not help remembering the lines:—

> If you can force your heart and nerve and sinew
> To serve your turn long after they are gone,
> And so hold on when there is nothing in you,
> Except the will which says to them "Hold on."

Walter Markby, Mosse Robinson, and Wm. Stagg were old friends whom I knew first in 1903 when I was appointed chief engineer to the Metropolitan Electric Supply Company. They were pioneers in the electric supply business, and remind me of other friends fortunately still with us, Frank Bailey, J. W. Drew, A. H. Walton, F. Hipwell, C. Gerhardi, W. C. Barrett, A. Oldham, and many others, all of whom were with the company in its earliest days more than 35 years ago.

Joining a great company as its chief technical officer is not generally an easy task, but my road was smoothed before me by the men who were my chief officers. A kinder welcome than I had could not be desired: I was made one of a happy band of brothers. It was hard and exacting work shared by all; first the old Sardinia Street station had to be put out of action in twelve months, and this was done in ten. Then we lost, through the sale of the Marylebone undertaking, one-half our revenue. It was a sore and difficult time for all hands to reduce costs so that the account should balance, and this great result also was accomplished. It is the sort of work that no laymen ever can appreciate, and only the engineers who accomplish it know whether it is well and truly done. Such results are arrived at only when all hands go all out, when those who are especially able to make good, without desire of praise, the inability of others. All really successful engineering work is done in this way.

Of the men in our happy gang who brought about these results, Markby and Robinson were well beloved and most distinguished members. Markby was superintendent of the Willesden power station, and saw it grow from the beginning, but he had seen greater growths. He had worked under the street in the old Whitehall Court station, and then with rope-driven alternators at Amberley Road. There was not a man in the Willesden works who would not do his best for Markby. He was not a highly gifted or highly trained engineer in the commonly accepted sense, but he had a real gift for devising gadgets; he devised a coal meter fitted to chain grates. He possessed great patience in his work which made him a priceless helper. Above all, in his position as chief, he gained the sympathy of everyone, and consequently obtained the best service that his men could render. He had a dignity of his own, and properly magnified his calling.

Wm. Mosse Robinson was mains superintendent under Norman W. Prangnell, who succeeded J. W. Drew. The office of mains superintendent in those days was no sinecure, but no man rejoiced in repairing joints on a canal bank on a dirty night before Robinson. He was a keen fisherman, and used to take an early holiday for the spring fishing on Tweed. I am not sure that his sport did not help in his keenness to visit the waterside. I hope and believe that on many a wild night on the Grand Junction Canal, Robinson saw in dreamy intervals the fair pools of Tweed and heard in the whirr of Evershed's generator the call of the driven reel. He had the heart of a true fisherman, kindly and patient. He and his gang and Stagg, his foreman, worked as one man. Stagg was one of the first men in the company's service, one of many notable old hands, a most competent man who could not do inferior work. He was fortunate in working in an age when the job was everything. He was one of many who helped in a humble but quite essential calling to build up the electrical industry. Little Stagg and "Tiny" Robinson both became heavier as time drew on, and both were proper men.

I write of days when masters and men were as one, and knew that their desires were for one end, the keeping of their homes, their company, and their country, and no man did more to maintain that most proper tradition than Walter Markby, Mosse Robinson, and Wm. Stagg.

I have written of six men who amongst my readers must own many friends, each of them notable in his own way, all of them helpers in the development of electricity and, consequently, in the Empire's work. All in their own circles were most respected. One was a hermit, one attained some wealth, the others in their several ways a competence. The money they earned will not weigh their worth; their friends may not measure it. There is no scale by which to measure the value of a man's life work. Therefore let us merely be glad that we have known such men and have rejoiced in their friendship, and recognise that by friendship, mutual forbearance, and common effort alone can we carry on the work to which these departed ones devoted their lives.

Railway Electrification in Norway.—The Committee of the Norwegian Engineers' Society, appointed two years ago to make inquiries into the possibilities of electrifying the railways and the building of new electric lines, has made its report, and affirms that, technically and economically, electric traction far surpasses steam traction. The report says that in the public interest, financially, and to gain freedom from foreign coal imports, the conversion to electric traction should be made at the earliest date.

E

The Southern Railway Electrification.—I.

The Suburban System: Some Facts and Figures.

The traffic increase which the Southern Railway Co. has had to deal with during the last ten years has amounted to no less than 59 millions. On amalgamation in 1923, each of the three chief companies concerned had adopted different schemes of electrification, which rendered the stock non-interchangeable, so that when they came under the control of the new board of management all the work that each had planned in 1914 had to be foregone. The 26 per cent. increase in passengers which had taken place during the war period of arrested development and excessive strain complicated reorganisation, the greatly augmented suburban traffic being the most difficult problem, as the morning and evening rush hours are restricted to three and two hours respectively.

Fig. 1.—Map of Southern Railway's Electrification Scheme.

The electrification of what may be termed the London suburban area of the Southern Railway is claimed to be the biggest thing of the kind ever undertaken. When complete it will consist of 650 miles of electrically-operated track, and the cost of the conversion from steam operation will have amounted to nearly eight million pounds: the reference map, fig. 1, and Table I afford an idea of the extent of the system.

The first of the extensions to be opened is the old Brighton railway from Norwood Junction to Balham, down to Sutton and Coulsdon North, fig. 1, representing about 82 track miles, which commenced carrying traffic on April 1st. This portion is worked on the overhead wire principle in the same way as the existing services on the Brighton section, but all the other electric services will be operated on the third-rail method, as is the case on the South-Western section.

TABLE I.

	Track miles completed.	Track miles in hand.	Total miles.
L. & S.W. Section...	178	67	245
Brighton " ...	70	82	152
S.E. & C. " ...	—	250	250
Cost	£2,250,000	£5,500,000	£7,750,000

In July next will follow the first portion of the South-Eastern and Chatham Railway for a distance of 115 track miles, which will provide electric services from Victoria, Holborn Viaduct, and St. Paul's to Orpington, *via* Nunhead and Catford, and also *via* Herne Hill and Beckenham Junction. At the same time it is hoped to open the extension of the already electrified system on the South-Western section from Claygate to Guildford and also from Raynes Park to Guildford *via* Leatherhead and Effingham Junction, while the old Brighton line from Leatherhead to Dorking North is also included in this particular section, representing 67 track miles.

In December next it is anticipated that a further portion of the South-Eastern section will be ready for conversion, from Charing Cross and London Bridge to Orpington, and the line from St. John's and Lewisham Junction down to Addiscombe Road as well as the Hayes and Bromley North branches, in all about 76 track miles. The final section is due for conversion early in 1926, and comprises the line from Cannon Street to London Bridge and the three lines serving Dartford, *via* Woolwich Arsenal, *via* Bexley Heath, and also *via* Eltham and Sidcup, about 62 track miles, which completes the scheme.

In many cases three electric trains will run where one steam train does duty now, and the increased facilities provided for have necessitated a very heavy coach-building programme. In all, some 850 vehicles are being furnished, some of them new, but many are steam stock converted at the Ashford and Brighton works of the company. The procedure at Ashford (the locomotive works of the old S. E. & C. Railway) in the preliminary stages consists of the construction of the steel frames, the erection of the coach bodies on the underframes, and the installation of the electric motors in the tractor coaches. When the coaches reach this stage, they are sent to Brighton in batches for upholstering, installation of electric fittings, painting, and general finishing work. Of about 850 new carriages, 537 are intended for use on the S.E. & C. section, fig. 2, and in order that there may be no delay in delivery, the services of outside contractors in different parts of the country are being utilised, in addition to the railway's own works at Ashford, Brighton, Lancing, and Eastleigh.

Fig. 2.—"Southern" Electric Train: South-Eastern Section.

New stations have been opened and many improved.

Variable-Speed Dynamos of the Third-Brush Type.

Some Notes on Self-Regulating Dynamos, for Train Lighting, &c.

By C. COPPOCK.

The equipment of various types of vehicles with electric light has created an enormous demand for a dynamo capable of giving a constant output over a wide range of speed.

In the field of motor-car lighting the third-brush dynamo has practically displaced all rivals, and it has met with a considerable measure of success in the more exacting sphere of train lighting.

Obviously a dynamo in which regulation of output is obtained over a wide range of speeds, simply by the addition of an extra brush, must, other things being equal, offer decided advantages over those employing complicated field regulators.

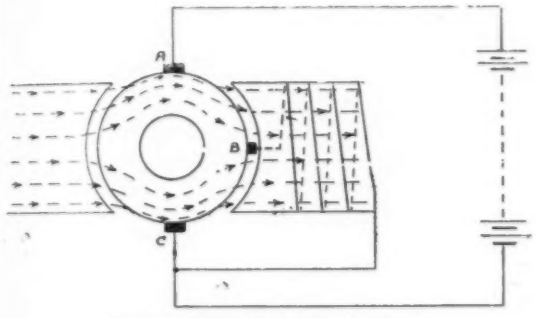


Fig. 1a.—Simple Third-Brush Dynamo.

Wind- and water-power developments in the future will doubtless create a considerable further demand for dynamos of this type in larger units and for higher voltages, and the machine is worth a close study in view of possible future developments.

The following notes apply more particularly to the third-brush dynamo in sizes of from 0.5 to 3 kW at 16 to 32 volts, such as are met with in train lighting.

For the sake of clearness in what follows, a short preliminary description of the dynamo and its principle of operation may not be out of place.

From fig. 1A, which shows the third-brush dynamo in its simplest form, it will be seen that the machine has a modified shunt field winding in which the shunt coils, instead of being connected between positive and negative main brushes, are connected between one main brush and a third brush set in an intermediate position.

The regulating properties of such a machine depend entirely on the phenomenon of armature reaction, which causes the main field to be distorted in the direction of rotation when the armature conductors carry current.

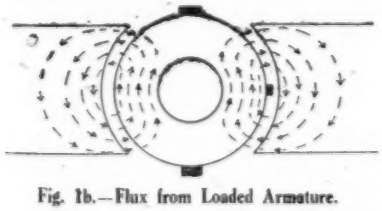


Fig. 1b.—Flux from Loaded Armature.

When the two-pole machine illustrated in fig. 1A runs without load the direction of the field flux is horizontal, and with the third brush in a midway position on the commutator the voltage between the third brush and either of the main brushes will be equal, provided we can assume an equal flux distribution over the pole faces and can afford to neglect the distorting action of the small field current flowing through one section of the armature conductors.

When the armature begins to carry a load current, a second flux is set up along the axis of the main brushes at right angles to the field flux, causing the latter to be distorted in the direction of rotation.

Fig. 1B shows the path of this second flux, and by combining figs. 1A and 1B, it can be seen that in the sector between brushes A and B the flux due to the armature ampere-turns is in the same direction and added to the main flux, but in the sector between brushes B and C the two fluxes are in opposition, and the resultant flux is the difference between the two.

Since in order to maintain a constant voltage between the main brushes, it is necessary that the field ampere-turns should decrease as the speed increases, it can be readily understood why it is necessary that the field winding should be connected between the third brush and the main brush behind it.

Such a machine, whose field is energised by a single winding shunted between brushes B and C, would be satisfactory for accumulator charging and, assuming a constant back e.m.f. and ohmic resistance in the outer circuit, its output would never exceed a certain predetermined figure, whatever the speed of its armature.

In practice, when the machine is required to supply a mixed load of lights and accumulators, it is usual to add a second field winding, either shunt or series, which is only energised when the lights are switched on, strengthening the field flux and increasing the dynamo output by any desired amount. Fig. 2 shows such a series winding connected in the lighting circuit.

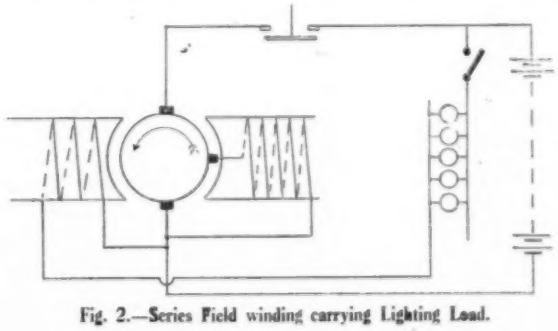


Fig. 2.—Series Field winding carrying Lighting Load.

By the addition of this extra field winding, the charge to the battery can be kept constant whether lights are off or on, a very desirable feature which ensures the battery being always charged at its most efficient rate.

The auxiliary winding has the further advantage that it re-energises the field each time the lights are switched on and obviates any danger of a failure to excite, a possibility always to be reckoned with in low-voltage machines.

Fig. 5 illustrates typical output curves of a third-brush dynamo with shunt excitation only, as in fig. 1, the lesser output curve being obtained by weakening the excitation.

Theoretically, the position of the third brush in these machines must be admitted to be far from ideal. Situated as it is midway between the main brushes, it short-circuits conductors which are cutting the densest part of the field, and it is inevitable that considerable

circulating currents should be set up through the brush. In practice, provided that one or two precautions are observed, no trouble need be anticipated from this source on low-voltage machines.

In explanation of the satisfactory performance of the third brush in practice, the following points should be borne in mind:—

These machines are usually designed for low pressures, seldom exceeding 35 volts, and the volts per commutator segment can therefore be kept low.

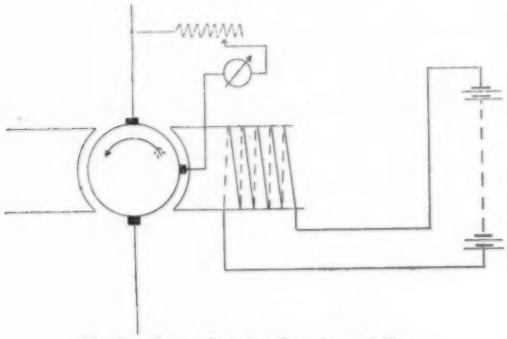


Fig. 3.—Connections for Experimental Tests.

The carrying capacity of the third brush need only be small; it can therefore be made as narrow as is consistent with reasonable mechanical strength in order to short-circuit the minimum number of segments, and it can be of a grade of carbon having a high contact resistance.

Further, commutation does not take place under the third brush, there being no reversal of current in the armature coils at this point, consequently the reactance of the coil plays a less important part than at the main brushes.

It is a matter of extreme difficulty to calculate with any degree of accuracy the magnitude of the short-circuit current under this brush, but the following experiment will give some idea of its value and the extent to which it can be reduced by adopting the most suitable grade of carbon:—

Run the dynamo on open circuit with separately excited field at a speed and voltage sufficient to cause sparking under the third brush. (The dynamo should first have been run for some time in one direction until the brushes are thoroughly well bedded to the commutator.)

Connect a variable resistance in circuit with an ammeter and switch between the third brush and the main brush in advance of it. (See fig. 3.)

Close the switch and decrease the resistance until sparking disappears at brush B. Sparking at the third brush will cease when the current in the armature coils between A and B equals the short-circuit current set up in the coils when passing under the brush; in other words, when there is no change in the magnitude of the current in a coil as it passes from under the third brush B.

Since the satisfactory performance of these machines depends very largely upon the design of the third brush and its holder, it may perhaps be permissible to emphasise a few points in this connection.

For machines which are required to run in either direction of rotation, the design of the third brush-holder is particularly important. The old-fashioned "claw" type of holder, which grips the carbon firmly, has advantages over the box type, in which there is relative movement between the carbon and holder. The tilting of a badly-fitted carbon in a box-type holder may cause considerable variation in output when the machine reverses, since the volts per bar are at a maximum under the third brush.

Suitable means should be provided for obtaining a fine adjustment of pressure, and this should be automatically kept constant as the brush wears down.

The width of the brush should for preference be less than the width of two commutator segments.

Brushes having a laminated structure with a high cross resistance may be used with advantage in certain cases, but these should not be necessary on machines of below 40 volts.

The battery plays an essential part in promoting good regulation in these machines, since owing to its negligible ohmic resistance any excess of dynamo voltage above the back e.m.f. of the battery will be accompanied by a heavy flow of current through the armature with an immediate demagnetising effect on the field, tending to maintain the terminal volts at a constant value.

Each increase in speed will give rise to a momentary increase of dynamo voltage accompanied by an increase in current, causing a reduction of field strength and a consequent return of the terminal volts to their previous value.

At every speed of the dynamo, after it has been connected to the battery, the armature current will adjust itself to such a value that, if armature losses are neglected, the product of field flux and armature speed will remain constant, and the curve connecting the two will take the form shown in curve A, fig. 4.

The speed at which the dynamo is automatically connected to the battery is usually termed the cut-in speed.

Assuming that there is no saturation in the magnetic circuit, curve A, fig. 4, will also show the connection between field ampere-turns and speed, and field ampere-turns can be plotted vertically in place of flux. Further, since the field winding is connected across the brushes B and C, curve A can, by a further change of ordinates, also represent the variation in voltage between these brushes as speed increases.

Now, if the voltage between the brushes B and C is to vary in the manner shown in curve A, that is to say, inversely as the speed after the "cut-in" point, it follows that the flux between brushes B and C must vary inversely as the square of the speed, as shown by curve B.

Further, granting the previous assumption that flux varies in direct proportion to ampere-turns, curve B can also represent the ampere-turns required to maintain the necessary flux between brushes B and C.

We therefore have curve A representing the field ampere-turns required at any speed to maintain constant voltage at the main brushes, and curve B representing the ampere-turns required to maintain the requisite flux and voltage between brushes B and C.

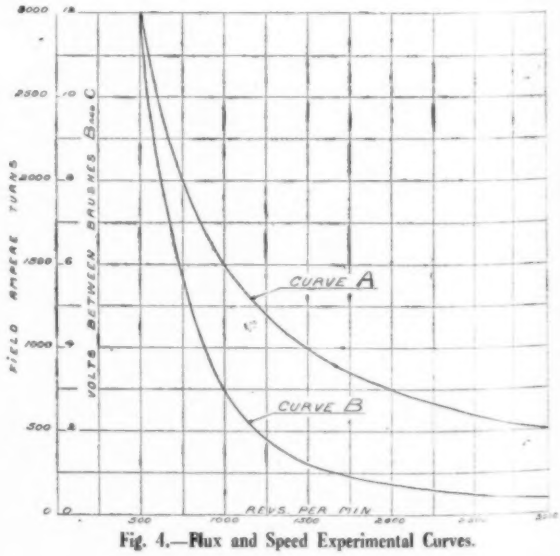


Fig. 4.—Flux and Speed Experimental Curves.

The vertical distance between the two curves will give us the ampere-turns which can be transferred to the armature to act in opposition to the field ampere-turns between brushes B and C, while still maintaining a constant voltage at the main brushes.

From a study of the curves in fig. 4 it will not be difficult to appreciate the reason for the shape of the current output curves in fig. 5.

At light loads the curve of current output is almost a straight line after reaching its maximum, but as the load is increased, due to an increase in field strength, the downward slope of the curve becomes more pronounced. To appreciate the reason for this, it is only necessary to imagine that the output curve does remain constant as speed increases.

The field strength must decrease inversely as the increase in speed as shown by curve A, fig. 4, otherwise there will be a variation in dynamo voltage and output.

In the sector between brushes B and C, we have two opposing m.m.f.'s, one due to the field ampere-turns, which are constantly decreasing, the other due to the ampere-turns on the armature, which we are assuming to remain constant.

If there is to be no falling-off of the armature ampere-turns, a point must be reached when the two m.m.f.'s will be equal and opposite, and there will be no resultant flux in the sector B C; in other words, the curve B, fig. 4, will cut the horizontal axis.

Since the excitation of the machine is dependent upon the flux between B and C, the armature ampere-turns must fall off before this point is reached.

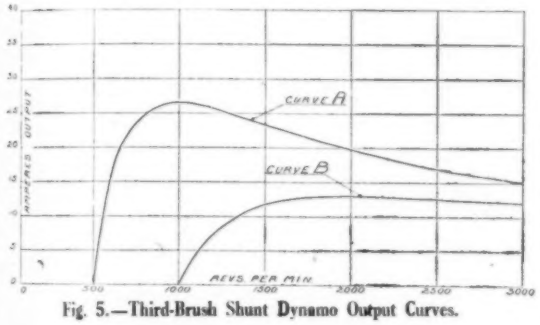


Fig. 5.—Third-Brush Shunt Dynamo Output Curves.

Owing to the many variables which affect the regulation of these machines, the exact predetermination of their output is a matter of considerable difficulty.

The following method of deducing a formula for this purpose, while not claiming to give more than approximate results, is of use in assisting a clear understanding of the machine, and when combined with an intimate knowledge of the general proportions of a particular range of machines, is sufficiently accurate to form a starting point for new designs.

It will be advisable first to summarise the assumptions on which the formula is based, and to consider to what extent each is justifiable:—

Assumption 1.—That the back e.m.f. of the battery, and consequently the dynamo terminal voltage, remain constant, not an unreasonable assumption with a battery which has not reached a fully-charged condition.

Assumption 2.—That the dynamo field flux will decrease in the same proportion as the speed increases, which will be justified if armature losses are neglected.

Assumption 3.—That the field flux varies directly as the field ampere-turns. This assumption is less justifiable than the foregoing, but since the degree of saturation of the iron circuit is slight after the full output point has been reached, the error introduced by this assumption is not great.

Assumption 4.—That the reluctances of the paths of the armature and field fluxes are equal. Since the reluctance of both paths is mainly in the air gaps, of which there are two in each path, and we have assumed no saturation of the iron, we shall not introduce a very serious error by this assumption.

Assumption 5.—That the main brushes are neither advanced nor retarded and the third brush is midway between the main brushes.

Then, having calculated the field ampere-turns required to generate an open-circuit dynamo voltage equal to the back e.m.f. of the battery, at the speed at which it is desired that the dynamo should "cut in," the preliminary formula becomes:—

$$AT_a = (AT_c/(sn/sc) - AT_c/(sn/sc)^2) \times K$$

where AT_a = armature ampere-turns per pair of poles.
AT_c = field ampere-turns at cut-in speed, per pair of poles.
sc = "cut-in" speed.
sn = any higher speed at which it is desired to calculate the current output of the dynamo.
K = a constant = 2.2.

Further explanation is required as to the purpose and value of the constant K.

Were the armature ampere-turns concentrated in a single belt of conductors all acting with equal effect at right angles to the main field, the need for this constant would not arise. In practice, since the armature ampere-turns are distributed round its circumference, and some are outside the polar arc, the case is less simple.

The value of this constant was arrived at by actual experiment and calculation extending over a considerable range of machines, its average value being found to lie in the neighbourhood of 2.2. The factors which chiefly cause variation in the figure are the following:—ratio of pole arc to pole pitch, shape of pole shoe, and degree of saturation of the teeth and pole tips.

The output curve "A," fig. 5, is plotted from the curves A and B in fig. 4, and is applicable to a two-pole generator having 250 face conductors on the armature.

The Institution of Engineers-in-Charge.

Annual Dinner.

The twenty-fifth annual dinner of the Institution of Engineers-in-Charge, held at the Holborn Restaurant, London, on Saturday last, was a highly successful function. Mr. T. Cooper (President of the Institution) presided, and many distinguished guests were present.

A telegram was sent to Buckingham Palace submitting the loyal devotion of the President and members of the Institution to H.M. the King, and wishing him a speedy restoration to normal health. Later in the evening a reply was received to the effect that the message would be forwarded to his Majesty, who would much appreciate the good wishes expressed.

The loyal toasts having been honoured, Mr. W. H. Patchell proposed "Science and Industry," and commented upon the co-ordination of the two. Had it been his duty, he said, to name the toast, he would have named it "Industry and Peace." Peace was even more urgent than science, because without peace among themselves they could not use their industry, and still less their science. He hoped the Prime Minister's lead in that direction would be taken in the spirit in which it was meant.

Dr. W. R. Ormandy, responding, said there were many directions in which science was progressing rapidly, but whether the progress was going to make for peace or not was questionable. Since the war they in this country had not kept up that regard for science which was so evident when the Government discovered that it could not do without the scientist and the engineer. Among the astonishing developments he had seen on the Continent was the production of methyl alcohol in Germany at less than £12 per ton, whereas manufacturers of dyes and of formaldehydes in this country, who used large quantities of methyl alcohol, were dependent upon America for supplies at £50 or £60 per ton. Another factor which might almost alter the equilibrium of the industrial world was that they had succeeded in Germany in converting coal into oil, to the extent of 93 per cent. The process was not yet on a commercial basis, but the technical difficulties still to be solved would, in his opinion, be solved. In two nations in Europe the Governments were keenly interested, and had acquired the rights, and it was a tribute to the growing appreciation of science in Government circles in this country that the Scientific and Industrial Research Board was by no means behind its Continental neighbours in the attention it was paying to this very important development.

Colonel Sir Arthur R. Holbrook, K.B.E., M.P., who proposed "The Institution," congratulated the members upon having elected Mr. Cooper as president for the second year in succession. After commenting upon the educational work of the Institution during the last 30 years, he said that they in this country could beat the world in engineering if they only made up their minds. Engineering in this country had arrived at a position which called for serious thought, and they should be settling down to see what could be done to restore their position as a great commercial power. He saw no necessity

for reducing wages here to the Continental level, but he did see the necessity for asking our workmen to give a full output for the wages they received, and that could only be done by the establishment of peace in industry. We were losing contracts in all directions. He did not blame the workmen for that, but was inclined to agree with Dr. Ormandy that those who were leaders of industry had not given sufficient attention to scientific research and had not brought their organisations up-to-date.

Mr. Cooper responded. After a brief reference to the good work accomplished by the Institution during the past year, he pointed out that the status of the engineer-in-charge had improved enormously during the last quarter of a century. It did not matter what was done in the way of efficiency in connection with the plant installed, or how good were the business arrangements—if it was not for the loyal support of the engineer-in-charge, all efforts would be in vain.

Mr. W. R. Welton (Chairman of the Technics Committee), proposing "Our Guests and Friends," expressed the appreciation of the members for the support given by the many eminent men in the engineering profession who were present that evening. In a reference to the co-operation between the various engineering institutions, he congratulated the Institution of Mechanical Engineers upon introducing economics as a compulsory subject for the Associate Members' examination.

Mr. H. G. Burford, in response, also emphasised strongly the benefits to be derived from the co-ordination of the interests of the various engineering institutions; both the members of the institutions and the country as a whole would benefit thereby. The Institution of Engineers-in-Charge was getting at the root of things, and he welcomed co-operation between it and the senior institutions as a means of reaching the desired end—success for industry.

The final toast, that of "Our President," was proposed by Mr. C. A. Pickles (Chairman of the Institution), who paid a glowing tribute to Mr. Cooper.

In response, Mr. Cooper returned thanks to Mr. Pickles, Capt. A. E. Penn (Hon. Secretary), and the members for the help he had received in his work as President.

Russian Notes.

The Electrical Bank and Imports.—The Electrical Bank has organised a department for the financing of the import transactions of the electrical trusts and electrical construction and for the centralisation of imports according to a plan prepared by the General Electrical Commission. The bank has already been entrusted by the Electric Machine Trust with the general representation of the latter in all foreign markets, and a similar agreement has also been entered into with the Central Electrical Trust, and the Institution will shortly extend its operations abroad in the matter of the purchase of electrical equipment for the trusts.

Electric Steel Production.—The situation of the Electric Steel Works has been reported on to the General Metal Commission in so far as its activity in the year ended last September is concerned. It is stated that the programme was fulfilled to the extent of 91 per cent., the output represented a value of 1,131,000 roubles, the average efficiency of the workmen was increased, and the costs of production were reduced. The net profits for the year are stated to have amounted to 84,000 roubles.

Estimates for 1925-26.—The Electrical Planning Commission had under consideration in February a report by the General Electrical Commission with regard to the "guiding budget figures" of electrification for the year 1925-26, amounting to 140,000,000 roubles. After discussion, the Planning Commission expressed itself in favour of the sum being increased to 160,000,000 roubles. The total comprises proposed expenditure on continuing the work of completing various regional stations, 15,000,000 roubles for railway electrification works, 17,000,000 roubles for the development of networks, 10,000,000 roubles for works in connection with rural industries, and a credit of 20,000,000 roubles for the electrical manufacturing industry.

Electric Ploughing.—The Planning Committee of the National Commissariat for Agriculture has approved a scheme submitted by an electrical company for rural construction in connection with electric ploughing. The company possesses 20 electric ploughing sets, for the use of ten of which orders have already been received, while an outlay of 72,000 roubles will be necessary to get the other ten sets placed in service.

Lamp Production.—The General Electrical Commission has put forward the question of the erection in Moscow of a works for the production of bulbs for lamps, having regard to the development of the lamp industry.

A Large New Generator.—The General Electrical Commission has recommended the immediate acquisition of a second 10,000-kW turbo-generator for the "Red October" station, owing to the growth in the consumption of energy in Leningrad and the expected difficulty of meeting the demand in the winter of 1925-26.

The Leningrad Trusts.—A report has just been prepared stating that it will be possible for the Electric Machine Trust of Leningrad to increase its output in the current year by 86 per cent. over that in the previous year. It will, however, be necessary to grant the trust a long-term loan of 4,000,000 roubles this year, while the total credit necessary during the present five-years' programme will amount to 7,973,000 roubles. It is intended to restart the Electro-apparatus works in 1926-27. In the case of the Weak Current Trust, the productive programme for this year represents a value of 6,800,000 roubles. Two works under the trust—the Krymsk and the Radio-Motor works—are lying idle, and it is suggested that they should be leased.

Electrification of Leningrad Industries.—In connection with the systematic development of the industries in Leningrad, the North-Western Industrial Bureau has again raised the question of the construction of a hydro-electric works on the Svir, particularly as the Volkhov station will be unable to satisfy the requirements of the industries in the city after a period of five years. It is calculated that by 1931 the demand will amount to 715,000,000 kWh per annum, whereas the State stations and the Volkhov works will only be able to furnish about 500,000,000 kWh. The construction of the proposed Svir station of a capacity of 135,000 h.p. would afford 450,000,000 kWh per annum, and thus supply the needs of Leningrad for a long time forward. The expenditure on the works, which would extend over five years, is computed at 65,000,000 roubles.

Trading in Electrical Manufactures.—The General Electrical Commission held a conference in the last week in February with representatives of the electrical trusts, trading organisations, and the share companies, with regard to meeting the electrical requirements in the current year. As a result of the reports presented, it was found that the trading organisations and the companies intended to purchase equipment to the extent of 16,500,000 roubles this year, of which 5,000,000 roubles was to be expended in the home market. In this connection it was stated that foreign firms were allowing the "Electrose'stroi" credit for from four to five years. The Electro-Exploitation Co., which proposed to expend 5,000,000 roubles, stated that foreign firms had offered the company credit for from seven to ten years, although for installation materials the period was only from three to four years. The Moscow Trading Undertaking, which intended to lay out 1,000,000 roubles this year, spent a similar sum last year, of which only about 8 per cent. was paid for Russian manufactures. Its representative stated that the undertaking would only purchase Russian products if they were able to compete in quality and price with those of foreign firms. During the course of further discussion complaints were made of delays in delivery on the part of the trusts. The representative of the Electric Machine Trust impressed upon customers the desirability of giving early notice of their requirements to the trusts, which would enable the latter to meet their wishes.

Expenditure upon Electrification.—According to official information published in Moscow, the total expenditure incurred by the State on works of electrification during the period 1920-1925 amounts to 142,000,000 roubles. The largest individual expenditure has been incurred on the Volkhov station (72,065,000 roubles), the Schatur station coming second with 18,511,000 roubles. Works of local electrification have involved an outlay of 10,690,000 roubles, or 7.5 per cent. of the total expenditure. If the materials, machinery, &c., which have been handed over to the stations in the past five years, apparently resulting from the dismantling of other works, are added to the cost, the aggregate expenditure by the State in the quinquennial period has ranged from 182,000,000 to 186,000,000 roubles.

Legal.

British Insulated & Helsby Cables, Ltd., v. Atherton (Inspector of Taxes).

An appeal in this matter has been set down for hearing (*ex parte*) in the House of Lords. It will, however, probably not be heard just yet. The earlier stages of the case, which turns upon the question of whether a contribution to a staff pension fund can be deducted from the profits of a company for income-tax purposes, were reported in our issues of July 4th (p. 44) and November 14th (p. 760), 1924.

Weber v. Birkett.

The defendant in this case, the borough electrical engineer of Southend-on-Sea, applied on March 30th for leave to appeal against the judgment of the Lord Chief Justice, which was reported in our issue of March 13th (p. 408). His counsel, Sir Henry Maddocks, K.C., said that Mr. Birkett had paid 200 guineas into Court prior to the trial of the action. The jury awarded the plaintiff £200, but declined to define the amounts awarded in respect of libel and slander respectively. In the course of argument before the Lord Chief Justice, counsel had asked for leave to amend the pleadings to show the payment of 200 guineas in satisfaction of the whole cause of action, but the Lord Chief Justice did not deal with the matter. The defendant had applied to the Lord Chief Justice for leave to appeal, but his Lordship declined

either to refuse or accede to the application (*vide* our last issue, p. 531).

The MASTER OF THE ROLLS, who, with Lords Justices Atkin and Sargant, heard the application, eventually gave defendant leave to appeal on two counts, *viz.*, the refusal of the Lord Chief Justice to enter judgment, and his refusal to give leave to amend the pleadings.

A Challenge Accepted.

A CASE of an unusual nature was heard at the Liverpool County Court recently, when Mr. William Edwards, electrician and radio dealer, Prescot Road, was successful in a claim for £50 and costs against the Wireless Clearing House, 102, Dale Street. Plaintiff's case was that he noticed in the window of the Wireless Clearing House an announcement offering £50 to anyone who could prove that any of the articles in the window sold at less than retail prices were only imitations of the genuine goods. Plaintiff purchased what were stated to be "genuine Ericsson Continental headphones." In his opinion these were not Ericsson's, and he claimed the reward, which was refused. He called evidence to prove that genuine Ericsson 'phones were only made through that firm's Continental factories at Stockholm, Vienna, Buda-Pesth, and Prague.

Mr. KENYON, for defendants, submitted that "Ericsson's Continental 'phones" was a name well known in the trade for any 'phones made on the Continent of Ericsson's type. They were sold as such by 75 per cent. of the dealers in this country.

His Honour Judge DOWDALL, giving judgment for plaintiff, said that Continental manufacturers made telephones of an inferior quality, and sent them to this country as "Ericsson Continentals." There was no doubt that a large business was done in this country by dealers in passing off cheap 'phones as Ericsson's, and the public were defrauded thereby. It was admitted that the 'phones in the case were made in Germany by a firm named Brauer, who had no connection with Ericsson's of Vienna.

Mayhall v. Electrical Distribution of Yorkshire, Ltd.

AT Leeds County Court, on March 30th, Mr. John Mayhall, of Leigh Lane, Horsforth, was awarded £62 15s. damages and costs against the Electrical Distribution of Yorkshire, Ltd., in respect of personal injuries received by falling into an excavation left insufficiently protected by the company's servants. Plaintiff said there were no chains to prevent people from walking into the hole, nor any red lights. The company stated that chains and lights had been placed near the excavation earlier in the evening in question.

The Shannon Hydro-Electric Scheme.

To Proceed as a State Enterprise.

AFTER two days' debate, on Friday last the Free State Dail passed, without a division, the Government's motion that the Shannon hydro-electric scheme should be proceeded with under State auspices. The terms of the motion were published in the ELECTRICAL REVIEW last week (p. 541).

The discussion was on an amendment by Mr. Conor Hogan (Farmers' Party) that the proposals should be further examined by other experts of international reputation with reference to the feasibility of the commercial exploitation of the river, with further reference to drainage, utilisation of existing roads and bridges, navigation and fisheries in the catchment area, and that, pending a favourable report by the second group of experts, no new work be initiated or obligations incurred by the Government.

This amendment was ultimately withdrawn. It is understood that the Government's Bill is ready, and that it will be introduced on the 22nd inst., when the Dail reassembles after the Easter Recess, and will pass through all its stages without much delay.

In moving the resolution, Mr. McGilligan, Minister for Industry and Commerce, pointed out that the motion referred only to the "partial development scheme," as modified by the experts.

More objections had appeared under the heading of what was called "drainage" than on any other point. Embankments would be made at every point where flooding could occur. The result would be that no flooding could be caused, even if the floods were as high as the highest recorded in thirty years. Water finding its way by percolation through the embankments, or falling on the land outside the embankments, would be dealt with by three different methods. Not one penny would be charged to any inhabitant along the banks of the Shannon for what happened under the partial development.

With regard to fisheries, it was impossible until the scheme had been in operation for a period of years to say how the fishery interests would be affected. If necessary, compensation money would be paid. Another matter was that of the market for power; Mr. McGilligan explained that at certain stages only certain portions of the work would have been completed, and only corresponding proportions of the income would be required to give a return on the money. If it were found that people in the country were refusing to take current, then they would not build for current beyond a certain point. When they embarked on that scheme they did not embark on an expenditure of £5,200,000 all at once, nor did they necessarily set out immediately to get an income of £436,000 from 1932. The price to consumers would depend upon the place where the current was sold. If delivered over a 100-kV line, the charge would be .52 of a penny; in other places, .84 of a penny. The scheme was not based upon the rise of new industries. The estimate of consumption per head in the cities was 115 kWh; in a city of 100,000 inhabitants in Norway the total consumption per head was 760 units, of which 405 was for domestic purposes. In another town in that country the consumption was 800 units per head for domestic purposes and 230 for industrial purposes.

Under the scheme of partial development, they were aiming at 35 units per head of the population in 1932, while Denmark at present consumed 55. It was not true to say that Denmark was getting its electricity cheaper, for the greater part of the power used in Denmark came by submarine cable from Sweden.

In proposing his amendment, Mr. HOGAN said he doubted whether the farmers would install electricity in their homes or farms.

Mr. DARRELL FIGGIS said that there should be a more careful and a fuller investigation of the Shannon scheme than it had received up to the present. In Zurich in nine years the consumption of electricity had developed twofold; no one believed that in Ireland in ten years it would develop threefold, as suggested by the experts.

Mr. JOHNSON, leader of the Labour Party in the Chamber, said that the small towns and villages should be treated in the same way as larger towns and cities, and that power should be provided at a flat rate.

Mr. JOHN GOOD, of the Dublin Business Party in the Chamber, said that the work was to be handed over to Messrs. Siemens, and the State would have to pay whatever price they liked to ask. He could not subscribe to the proposals without further inquiry. He dwelt on the cost of installation, for which, he said, no provision had been made, and to which no consideration had been given, and said that unless they could get over the difficulty, he was afraid the demand would be an exceedingly poor one.

After further discussion, Mr. Hogan's amendment was withdrawn and the motion was passed without a division.

In the Free State Senate, Sir JOHN P. GRIFFITH moved that a Special Commission should be appointed to consider the documents, to inquire into the present consumption of electricity in the Free State, and the rate at which it was likely to increase in the future; and to report whether a scheme of such magnitude should be undertaken by the State at the present moment, having regard to the financial and economic resources of the State. Sir John declared that the proposals of Messrs. Siemens-Schuckert involved grave engineering, financial, and agricultural risks.

After some discussion the motion was withdrawn.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Depression of Electric Strength of Oil during Storage.

Being naturally interested in the recent correspondence in the ELECTRICAL REVIEW dealing with tests made on a De Laval centrifugal oil purifier, it may be of interest to your readers to know how the tests, which have been so unfairly quoted by one of our competitors, were carried out, and the following shows what actually happened during Mr. Jukes's test No. 13 (see ELEC. REV., December 5th, 1924, page 847).

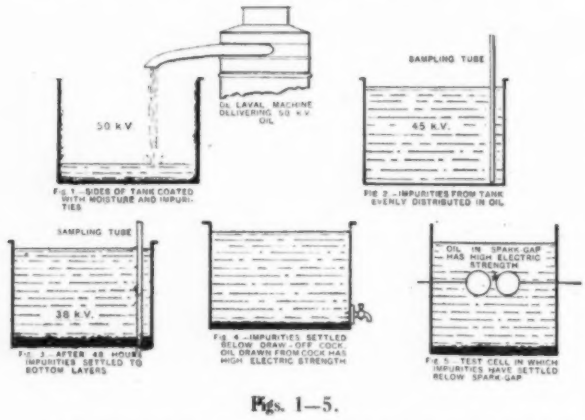
Fig. 1 shows a De Laval machine delivering 50-kV oil into an empty tank which has previously been standing in an unheated works during rainy weather. Consequently, before the oil is run in, the walls and bottom of the tank are coated with a film of moisture and possibly also with a certain amount of dust and other impurities.

Fig. 2 shows the result of running the 50-kV oil into the above-mentioned tank, *i.e.*, the moisture and other impurities get uniformly mixed with the purified oil. If now a sample is taken from any part of the tank, the electric strength must be less than before, and, as Mr. Jukes's test No. 13 showed, was (purely as the result of running oil into the tank) reduced by 5 kV, *i.e.*, to 45 kV.

Fig. 3 shows the state of affairs after the oil has been left undisturbed for 48 hours; due to natural settlement, the greater part of the impurities will have gravitated to the bottom and, consequently, if a sample is taken with a sampling tube, as

was done during the tests referred to, the oil so drawn must contain a greater percentage of impurities than the sample taken when the impurities were evenly distributed. Therefore, the oil must be of a lower electric strength and, as the tests correctly showed, this has now decreased to 38 kV. From figs. 1, 2 and 3 it is clear that the results obtained have nothing whatever to do with the absorption of moisture by fibres, as we believe that our competitor supposed. In connection with the subject we would draw your readers' attention to two further interesting tests which have been made.

Fig. 4 shows the result of drawing a sample of oil from the bottom of a tank in which the oil has been standing for some time. If the oil has remained undisturbed, practically all the impurities will have settled down into the bottom ¼ in. of oil, but due to the flange on the draw-off cock it is impossible to remove even the last ¾ in. of oil; consequently, the sample from the cock will show a high electric strength.


50 K.V.
DE LAVAL MACHINE DELIVERING 50 K.V. OIL
FIG 1.—SIDES OF TANK COATED WITH MOISTURE AND IMPURITIES
SAMPLING TUBE
45 K.V.
FIG 2.—IMPURITIES FROM TANK EVENLY DISTRIBUTED IN OIL
SAMPLING TUBE
38 K.V.
FIG 3.—AFTER 48 HOURS IMPURITIES SETTLED TO BOTTOM LAYERS
FIG 4.—IMPURITIES SETTLED BELOW DRAW-OFF COCK. OIL DRAWN FROM COCK HAS HIGH ELECTRIC STRENGTH
OIL IN SPARK GAP HAS HIGH ELECTRIC STRENGTH
FIG 5.—TEST CELL IN WHICH IMPURITIES HAVE SETTLED BELOW SPARK GAP

Figs. 1—5.

Fig. 5 shows what happens when oil is left standing in a test cell. As the electrodes are situated a considerable distance above the bottom, any impurities originally present in the oil, or which may get into the oil whilst standing, settle to the bottom, with the result that the oil in the vicinity of the spark gap is uninfluenced by the impurities and shows a high electric strength.

The illustrations clearly show that unless a sampling tube is employed, as during the De Laval tests and as specified in British Standard Specification No. 148 and also in Specification No. 117 of the American Society for Testing Materials, the breakdown values obtained may give an entirely false indication of the true condition of the oil. We have in figs. 1 to 3, inclusive, clearly shown the manner in which the De Laval tests were carried out, and we challenge our competitor to show how the results claimed in his advertisement were carried out. On the latter point we are much inclined to suspect that he may have been deceived by some such conditions as those illustrated in figs. 4 and 5.

De Laval Chadburn Co., Ltd.
W. R. Chadburn, *Managing Director.*

London, *March 27th*, 1925.

L.C.C. Wiring Regulations for Exhibitions.

We desired to employ C.T.S. cable for wiring our stand at the forthcoming Nation's Food Exhibition, not only for the lighting, but also for several motors and an electric oven.

It is not necessary to write much to express our surprise that such cable is not allowed. Apparently wiring must be in "armour," or else the primitive and unsightly wood casing, to satisfy the whims of that backward Juggernaut, the London County Council. Note that there are no special regulations for electric baking ovens.

We enclose a letter on the subject which will no doubt interest your readers.

Artofex Engineering Works, Ltd.,
W. Ellerd-Styles, M.I.E.E., *Managing Director.*

London, *March 31st*, 1925.

[The enclosure is a letter from a well-known firm of consulting engineers, stating that the London County Council does not allow the use of C.T.S. cable unless it is a manufacturer's own exhibit; screwed barrel or wood casing must be used.—Eds. Elec. Rev.]

Free and Hire-Purchase Wiring.

I heartily agree with your correspondent, Mr. L. G. Hawkins, in your issue of March 27th, with regard to broadcasting to the public the advantages of free and hire-purchase wiring, but would like to point out that many of the undertakings in the country are only permitted to give "Simple Hire," with the result that many consumers are lost to the industry, as they will not consider having their premises wired when the installation never becomes their own property.

Where an undertaking has no wiring department, I think the time is ripe for the "powers that be" to alter the regulations from simple hire to hire-purchase, with the proviso that "all the work be given to the contractors," for it is only by the undertaking working in perfect harmony with the contractors that a scheme of this nature can be carried out on very progressive lines to the mutual benefit of both parties.

I know from experience that many people refuse to take any electrical apparatus on simple hire terms, preferring in some cases to buy the apparatus, but I regret to say that in many cases valuable load has been lost through the person being unable to purchase the article outright.

F. B. Humphriss.

Paisley, *April 4th*, 1925.

Maxtorq Motors.

We read with interest the letter of the Lancashire Dynamo and Motor Co., Ltd., in your issue of March 27th regarding "Maxtorq" motors, and especially the remarks in your footnote stating that the test conditions described were abnormal. We know of another maker who has been manufacturing motors of similar type for many years and who claims that the rotor will withstand similar treatment without getting red hot, or, indeed, without injurious heating. The condition, however, is abnormal and undesirable for any a.c. motor to work under in practice, because the line current must be very large and the power factor low.

It is, however, by no means abnormal for a winch or capstan to be stalled for five minutes—rather is it the ordinary duty required of such machines.

It is not generally known that the constant-current motor and generator is now available for these hitherto abnormal loads, and that by its use a static torque or strain in excess of full-load torque can be maintained for any duration, the load on the supply system being reduced to from 5 to 10 per cent. of normal full load.

With this system enormous speed ranges are available, such, for example, as variable speeds of 100 to 1, and steady speeds over an adjustable range of 20 to 1.

Considering that the system abolishes fuses or circuit-breakers, reduces switchgear, resistances, and cable work, and that any load which would be abnormal for an ordinary a.c. or d.c. motor is quite normal for the constant-current motor, we think this method may become an important factor in popularising the electric driving of machinery.

The possibilities of the system so ably advocated by M. Thury for long-distance transmission have surely been overlooked in regard to industrial driving.

For **Gilbert Austin, Ltd.**
Wm. Manson, *Director.*

Glasgow, *April 4th*, 1925.

Replying to Mr. D. B. Hoseason's letter in your issue of April 3rd, the word "Maxtorq" is a registered trade name covering the series of squirrel-cage motors made by this company.

We are not surprised that Mr. Hoseason is mystified, as he inquires if "the Maxtorq motor is a new type ideally suited for both hoists and mule drives." It would indeed be a wonderful motor—not to say an impossible one—that was right for both jobs. The whole point of the "Maxtorq" motor is that it is not one motor, but a series of squirrel-cage motors, each of which has been developed for a particular class of job. A continuously running line shaft is not the same thing as a crane, and a centrifugal pump is not like either of them, still less is a rapidly reversing set of rolls, and we should never think of putting forward the same motor for these different cases.

We manufacture six types of Maxtorq rotors for various duties, and this is one of the reasons for the success of the Maxtorq motors. For every duty we have the correct Maxtorq motor with the best starting torque, the best efficiency and power factor, and the best general characteristics to make it most suitable for the job to which it is applied.

The Maxtorq motor is not an "ordinary standard motor." The proof of this is the number of jobs for which slip-ring motors were considered essential, which are being satisfactorily driven by Maxtorq squirrel-cage motors.

As a matter of policy, we have rather refrained from thrusting down our customers' throats any highly technical description of the details of the Maxtorq motor construction, preferring to convince them that the motor will do what we claim for it, which is what no other motor in the world will do. We have, therefore, rather tended to confine our description of the special construction of this motor to the following:—

"The rotor has divided end rings, specially designed windings, and in some cases magnetic eddy-current disks, all of which cause the rotor to have a higher effective resistance at starting than when up to speed."

We are glad that the question of one motor being suitable for all duties has been raised, because every few years a new squirrel-cage motor is advertised (usually from the Continent) stating that this one design of motor is suitable for every possible drive, and the final result is always to send people back to slip-ring motors. If a user of motors wants to get

rid of slip rings, he should exercise some care in seeing that he gets a motor suitable for the job it has to do. We have often come across cases in crane work where crane-makers have applied an ordinary standard squirrel-cage motor in which the maker has simply fitted the rotor with brass bars instead of copper and then called it a high-torque crane motor, ignoring the fact that the main points for a crane motor are smooth acceleration and close inching.

We enclose our Maxtorq catalogue No. 701.

Lancashire Dynamo & Motor Co., Ltd.
A. P. WOOD, *Managing Director.*

Manchester, *April 4th*, 1925.

The Shannon Scheme.

The wonderful propaganda with reference to the Shannon scheme seems to have penetrated (unintentionally, of course, on your part) even into the pages of the ELECTRICAL REVIEW. In your Editorial comment in last week's issue you stated that the average price was not likely to be less than one penny per unit—again naming the price which the propaganda always coupled with the Siemens-Schuckert scheme.

On page 161 of the Siemens report an area including **Mallow** and its surroundings is taken as an example to arrive at the average price per unit in the Irish Free State. It is shown that the price in this area is to be no less than 6.8 pence per unit, which, in the expressed opinion of Messrs. Siemens-Schuckert, "cannot be considered excessive."

In arriving at this price some amazing anticipated day load curves are put forward on page 83 of the report. Heating is expected to consume about half the power of the Shannon plant and one-third of the total day's output between 9 p.m. and 7 a.m. This heating is to be prohibited between 7 a.m. and 9 a.m., it is to be allowed only partially between 9 a.m. and 5 p.m., and it is again to be prohibited between 5 p.m. and 9 p.m. This "artificial heating demand is the vital factor of the whole scheme, and removing it from the picture, as must be done when things reach the practical stage, causes the collapse of all the calculations.

The anticipated industrial demand curve is moved an hour or two out of its proper position, resulting in no overlapping of the industrial and lighting demands on a winter's afternoon. The domestic demand shows an accommodating valley between 2 p.m. and 7 p.m., and the lighting peak is clipped off to a very moderate figure, all resulting in a wonderful composite day-load curve with practically no valleys and no peaks, showing Messrs. Siemens-Schuckert's extreme optimism, and their skill in juggling with the critical points.

By such tactics Messrs. Siemens arrive at their vital figures, and even then 6.8 pence per unit to consumers at Mallow is the best they can put forward.

J. Murphy.

Bandon, Co. Cork, *March 30th*, 1925.

[The suggestion that the average price to the consumer was not likely to be less than 1d. per kWh related only to Dublin. The promoters assume that the consumption per head will be increased to 126 kWh in the cities by the time the Shannon supply is available, and to 174 eventually, and under these conditions with bulk supply at 0.53d. the average price should not be much more than 1d. per kWh. But we by no means endorse any of the promoters' figures.—EDS. ELEC. REV.]

The Dimensions of Commutators.

It was with appreciation that I read Mr. Thomas Carter's article entitled "The Dimensions of Commutators," and thereby learnt an excellent method by which certain data I gave in my article on "The Heating of Commutators" could be applied to the design of commutators.

With regard to Mr. Henderson Haynes's letter on the subject in your issue of the 27th instant and his suspicion that the electrical characteristics of a machine have a close bearing on the heating of commutators (presumably with interpole machines accurately built to a reasonably proportioned design), I am interested, particularly as it was only after much careful research that I ventured to state my opinion (on what I realised was a much debated question) that "there is nothing from this source to interfere with our figures." However, I was careful to surround that statement with certain warnings and qualifying observations, because I have had commutators which at first have exhibited temperature rises in no way reconcilable with anything calculable from my curves. In such cases complete investigation has invariably led to the trouble being diagnosed as due to one or both of the following:—

(a) Electrical phenomena set up by errors in construction, such as faulty spacing of brushes, irregularities of the magnetic circuit, span of armature coils wrong, &c., &c.

(b) Brushes inconsistent with values stated by the makers or otherwise faulty.

In connection with the particular case, mentioned by Mr. Henderson Haynes, of commutator heating not agreeing with Mr. Carter's formula, almost nothing is given to enable one to explore the potentialities of the machine to develop electrical phenomena of a nature which would increase the temperature rise of the commutator. But we do find this, that when graphitic brushes of moderate resistance were replaced by low-resistance copper-graphite brushes the temperature rise of the commutator dropped from 151 deg. F. to 51 deg. F., which is tremendously more than in proportion to the decrease of the total commutator losses as calculated from the constants stated by the brush makers. Yet generally the action of any electrical phenomenon within a machine tending to increase the heating of the commutator is opposed by the contact drop of the brushes, so that its magnitude would increase with decrease of brush contact drop, and hence the result of fitting brushes of lower resistance would be to decrease the temperature rise of the commutator in a proportion smaller than that by which the loss (calculated from the brush contacts) is reduced.

This leads me to suspect that if Mr. Henderson Haynes will test the two sets of brushes under exactly similar conditions on a commutator so disconnected and short-circuited as to be unquestionably devoid of the influence of machine characteristics, he will ascertain that at least a contributary cause of the discrepancies is of the nature "*b*" given abóve.

Respecting brush troubles the following facts may be of interest:—

Not long ago the writer found that the commutators of some motors were exhibiting temperature rises 60 to 66 per cent. more than that recorded in respect of some duplicate machines constructed three years previously. There was available one of the earlier constructed motors which still had its original brushes. These were taken off, and comparison with the brushes of recent consignments revealed an obvious difference in consistency; and when a new motor was run with the old set of brushes fitted, the temperature rise of the commutator fell to the value recorded in respect of the earlier machines. The same grade of graphitic brush was specified throughout, and the makers *did not* revise their declared constants in the meantime! The writer knows that the serious decline in the quality of this brush was proved also by several other designers, and as a consequence its use had to be discontinued in at least four manufacturing works in this country.

It is the writer's experience that while some makes of brushes seem unfailing in their performance, others from time to time give trouble.

Percy Huggins.

Wakefield, *March 31st*, 1925.

I sincerely thank Mr. Haynes for the courtesy of his appreciative letter, and particularly for his statement that, speaking generally, the formulæ in my article enable results to be predicted with remarkable accuracy. There will always be odd and exceptional cases, sometimes capable of explanation, and sometimes not: the machine described by Mr. Haynes, for example, looks quite normal on paper, and my judgment would be that a commutator 9.375 in. in diameter and 7 in. in length, running at 800 r.p.m., should carry 416 amperes comfortably. What caused the abnormal rise in temperature I cannot pretend to explain; it may have been electrical, or it may have been mechanical, but only the man who can see the machine is able to deal precisely with unusual trouble. I regard it in the present connection as the exception that proves the rule, and the last paragraph of Mr. Haynes' letter shows that the rule emerges safely from the proving.

I agree that not every result is capable of prediction exactly, and that electrical (and, I would add, mechanical) conditions and characteristics must be taken into account. As I stated in my article, it began to some extent where Mr. Huggins's article left off, and the two should be read together. I understand Mr. Huggins to mean that his curves apply to machines having good commutation, either because interpoles are used or because the constants are inherently favourable; this clearly implies that there may be machines in which these good conditions do not exist, and to which the formulæ will therefore not apply without correction. Further, Mr. Huggins referred to the mechanical precautions that must be taken to ensure consistent results. It was thus unnecessary for me to mention either of these two vital matters.

I hope that what I have said will appear to Mr. Haynes to answer the very important point he has raised. I think that if he will refer again to both of the articles he will find that between them they really do cover all the essential ground.

Thomas Carter.

Newcastle-on-Tyne, *March 30th*, 1925.

Conditions in South America.

Can any reader give me information as to the possibilities of obtaining a position in South America? I am a young engineer with ten years' practical experience in electrical contracting work, and having some knowledge of Spanish, am considering going out in the hope of securing a position when I arrive.

Hispano.

The Electric Iron.

Regarding "Observer's" criticisms in your current issue, we have very great pleasure in endorsing your remarks, particularly that relating to brains. We do not think "Observer" will recover from his failure to market a fireproof iron by condemning other features which have proved a boon to the sale of these very useful and serviceable appliances.

The Electric Heating Co.

Croydon, *April 6th*, 1925.

Business Notes.

Bankruptcy Proceedings.—J. H. Painter (Venables & Co.), electrician, 99, The Broadway, Cricklewood, N.W.—Receiving order made March 26th on debtor's own petition. First meeting held April 9th; public examination, April 28th, both at Carey Street, W.C.

A. H. Moncrieff, wireless manufacturer, late of 60, Thornton Road, Bradford.—First meeting was called for April 8th at the Official Receiver's office, Bradford. Public examination, May 4th at the County Court, Bradford.

E. Owen (E. Owen & Co.), wireless dealer, 1, Senghenydd Road, Cardiff.—First meeting held April 9th at 34, Park Place, Cardiff. Public examination, May 6th, at the Law Courts, Cardiff.

N. P. Jones, electrical engineer, 23, High Street, Denbigh.—First meeting held April 7th, at the Official Receiver's office, Chester. Public examination, May 12th, at the County Buildings, Wrexham.

H. Farnell, plumber and electrician, 183, Higher Hillgate, Stockport.—Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester, released March 25th.

A. Smith (Smith & Gill), electrician, 57, Albion Street, Nelson.—Last day for proofs for dividend, April 14th. Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston.

J. Munro (J. Munro & Co.), electrical engineer, 296, Allison Street, Glasgow.—Public examination held April 7th, at County Buildings, 50, Wilson Street, Glasgow. Meeting of creditors, April 16th, at the offices of Messrs. D. Spalding and Muir, 190, West George Street, Glasgow.

E. A. Thorn, house decorator and electrical engineer, 22, Mossbury Road, Clapham Junction, S.W.—Last day for proofs for dividend, April 20th. Trustee, Mr. T. Gourlay, 29, Russell Square, W.C.

Company Liquidations.—Brunswick Manufacturing Co., Ltd., manufacturers of radio goods, 79, East Road, and Vestry Street, City Road, N.—A meeting of creditors was held recently at the offices of Mr. E. A. Shock, accountant, Queen Victoria Street, E.C. Mr. Shock stated that the company had gone into voluntary liquidation and had appointed him to act as liquidator. He submitted a statement of affairs which showed liabilities of £1,834 and assets of £295, from which had to be deducted £46 for preferential claims, leaving net assets of £249, or a deficiency of £1,584, so far as the creditors were concerned. Mr. Shock stated that the business was originally carried on by a Mr. Hereford, who, in the early part of last year, managed to interest Mr. S. A. Abelson in the possibilities of the concern. The company was registered in March, 1924, when 500 preference shares of £1 each were issued for cash. Six ordinary shares of £1 were also issued for cash, and Mr. Abelson and his brother had since financed the company and had made loans totalling £692. Mr. Shock said it would appear that the business had never been carried on profitably, and orders had been executed at a loss. The total sales were £3,910, and it appeared that the goods cost something like £4,000 to make. The goods were sold below cost, and there was a gross loss on the trading of £247. The expenses of the business, in addition, had totalled £1,900.

Mr. Shock also stated that an execution was levied by a creditor on March 18th. Judgment had been obtained against the Brunswick Manufacturing Co. and not against the limited company. On March 24th the name of the limited company was added, and the following day the sheriff again levied execution. A point would therefore arise as to whether the execution was valid, as the liquidation took place on March 18th. It was stated that the claims of certain of the creditors had been guaranteed by Mr. Abelson. Efforts were being made to sell the business as a going concern, and it was believed that something in that direction could be effected. It was unanimously decided to confirm the voluntary liquidation of the company, with Mr. Shock as liquidator, and an informal committee was appointed, consisting of the representatives of the British and Foreign Timber Co., Messrs. F. T. Morrell & Co., and Messrs. Hoffman & Co.

Motolite Dynamos, Ltd.—Winding up voluntarily. Liquidator, Mr. L. S. Challis, 69, Hazlewood Road, Putney.

Meeting of creditors, April 15th, at the Cannon Street Hotel, E.C.

Film Cooling Towers, Ltd.—Particulars of claims to the liquidator, Mr. K. W. Branczik, 124, Chancery Lane, W.C., by April 30th. A meeting of members is called for May 14th at 124, Chancery Lane, to hear an account of the winding up.

Birmingham Wireless Co., Ltd.—A meeting of members is called for May 5th at 3, New Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. S. W. Hart.

Ford Electrical Co., Ltd.—Particulars of claims to the Liquidator, Mr. J. F. Stoff, 10, Norfolk Street, Manchester, by May 12th.

Auckland Wireless, Ltd.—A meeting of members is called for May 4th, at 64, West Smithfield, to hear an account of the winding up from the Liquidator, Mr. F. G. Jenkins.

Electro Chemical Mfg. Co., Ltd.—A meeting of members is called for May 4th, at Oxford House, 9-15, Oxford Street, W., to hear an account of the winding up from the Liquidator, Mr. G. E. McCaulis.

Prendergast Electrical Engineering Co., Ltd.—A meeting of creditors was called for April 8th, at 122, Wigmore Street, W. Liquidator, Mr. G. H. Ellis.

Wireless Experts, Ltd.—Winding up voluntarily. Liquidator, Mr. D. V. L. Craddock, 2, Forbury, Reading.

B. Barnett (Electrical Engineers, Leyton), Ltd.—A meeting of creditors is called for April 9th, at the offices of the Liquidator. Particulars of claims to the Liquidator, Mr. M. J. Wilson, 149, Farringdon Road, E.C., forthwith.

Fallon Condenser Mfg. Co., Ltd.—Meeting of creditors, April 14th, at the Liquidator's office, 122-3, Moorgate Street Chambers. Particulars of claims to the Liquidator, Mr. R. H. Dutchman, by May 9th.

Stanley Engineering Co., Ltd.—Meeting of creditors at 145, St. Vincent Street, Glasgow, April 17th. Liquidator: Mr. J. W. Mackinnon.

Napier-Kimber, Ltd.—By an Order of Court dated March 24th, a meeting of creditors will be held on April 16th at 24, Basinghall Street, E.C.2, to decide whether the voluntary liquidation should be continued or the company should be compulsorily wound up.

Private Arrangements.—F. S. Rumball, electrical engineer, 29, Manchester Street, Luton.—A meeting of creditors was held recently, when a statement of affairs was submitted, which disclosed liabilities of £430, all due to unsecured creditors. The assets totalled £51, from which had to be deducted £20, leaving net assets of £31, or a deficiency of £399. It was reported that the debtor had executed a deed of assignment to Mr. W. H. French, accountant, of Church Street, Luton, as trustee. The solicitor intimated that it might be possible to put forward an offer of 5s. in the £ to the creditors.

Radiophones, Ltd., 4a, Savoy Hill, Strand, W.C.2.—A meeting of creditors was held on April 1st at the offices of Messrs. C. Butcher & Simons Burns, solicitors, Gresham Street, E.C., when the chair was occupied by Mr. C. Frey, of the Anglo-Swiss Screw Co., Ltd., creditors for £706. An approximate statement of affairs was submitted, which showed liabilities of £4,886, of which £4,487 was due to trade creditors, and there was a cash creditor for £400. The assets were valued at £1,830.

The solicitor said that the managing director of the company was under the false impression that the company was quite solvent. Just before Christmas the company gave large orders for condenser parts. The goods were not delivered in time, and consequently practically all the contracts fell through. An offer of 5s. in the £ in cash was made. If the creditors did not accept that, the only other course would be for voluntary or compulsory liquidation to take place. The company was formed on July 14th, 1922, with a nominal capital of 5,000 shares of £1 each. Of that amount 4,250 shares were taken up and 10s. was called up on each. The managing director said that 2,000 were transferred to him and the rest were taken up by friends of his. It was eventually decided that a committee of five of the largest creditors should be appointed to investigate the matter. The committee consisted of Mr. C. Frey, of the Anglo-Swiss Screw Co., and the representatives of Messrs. A. Graham & Co., Radio Instruments Co., Busby & Co., and the Sterling Telephone & Electric Co., Ltd.

The following are creditors:—

	£		£
American Hard Rubber Co.	22	Hughes, F. A.	59
Armstrong, Stevens & Son	195	Portable Electric Light Co.	37
Anglo-Swiss Screw Co.	708	Portable Utilities Co.	42
British Thomson-Houston Co., Ltd.	50	Radio Instruments, Ltd.	216
British Broadcasting Co.	30	Vandervell, C. A., & Co., Ltd.	185
Brown, S. G., Ltd.	50	Lessin, Ltd.	55
Dubilier Condenser Co.	290	Smith's Advertising Agency	154
Ego Engineering Co.	68	Sterling Telephone & Electric Co., Ltd.	270
Teurins, Ltd.	57	Standard Screw Co.	150
Graham, Alfred, & Co.	150	Siemens Bros. & Co., Ltd.	60
Igranic Electric Co., Ltd.	265	Robinson & Sons	150
London Electric Wire Co.	60	Busby & Co	294
Mullard Radio Valve Co., Ltd.	20	Kaye, E. & E., Ltd.	30
Harris Plating Works	45	Bissell, E. H., & Co.	20
McLeod & McLeod	85		

Deeds of Assignment.—L. Brilleant (L. Brilleant, Brilleant Wireless Co., and C. May & Co.), jewellery, wireless, and fancy goods dealer, 56, Bank Chambers, High Holborn, W.C., Marine Arcade, Great Yarmouth, and Marine Drive, Margate.—Particulars of claims by April 14th to the trustee, Mr. A. E. Quaife, 155, Fenchurch Street, E.C.

J. D. Campbell, electrical engineer, 15, Allan Street, Arbroath.—Particulars of claim to the trustee, Mr. T. P. Drever, solicitor, Arbroath, by April 13th.

Dissolutions of Partnership.—Hunt & Moya, electrical engineers, 46, Park Crescent Mews West, W.1.—Mr. A. Moya and Mr. W. J. Hunt have dissolved partnership. Mr. Moya will attend to debts and continue the business under the same style and at the same address.

Mr. Thomas Fletcher Clarke has retired from the firm of Corlett Bros. & Co., electrical engineers, of Hilary Park and Buck's Road, Douglas, Isle of Man, and the business will be continued by Mr. James Stephen Corlett and Mr. John Henry Corlett, under the style of Corlett Bros. & Co.

Trade Announcements.—Mr. C. E. RUSSELL has opened new premises as an electrical and wireless engineer at 61, Bohemia Road, St. Leonards, Hastings.

The business of Mr S. E. HUNT, electrical engineer and contractor, 272, Brighton Road, South Croydon, has been acquired by Mr. F. PRITCHARD, A.M.I.E.E., A.M.I.Mech.E., formerly proprietor of the Rugby Electrical Engineering Co., as from April 1st.

In order to avoid confusion, Messrs. E. O. WALKER & Co., of 26, Cannon Street, Manchester, ask us to state that they are not in any way connected with Messrs. Walker's Wireless, of Newcastle, or with any other firm, their only addresses being at Manchester and Wrexham.

MESSRS. T. J. GRAINGER & Co., LTD., announce that their new address for all communications and stores is:—20, Eldon Square, Newcastle-on-Tyne.

Messrs. J. W. & R. TORRANCE, of Campbell Street, Hamilton, have disposed of the electrical engineering part of their business to their foreman, Mr. W. Y. McAdam, who will carry it on at 11, Campbell Street.

MESSRS. BAXTER & CAUNTER, LTD., of Tottenham Court Road, W.1, announce that their telephone number has been changed to:—"9301 Museum" (six lines).

Catalogues and Lists.—THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—A series of illustrated leaflets dealing with the company's oil circuit breakers and flame-proof relays.

MESSRS. S. WOLF & Co., LTD., 115, Southwark Street, S.E.1.—An illustrated folder advertising portable electric drills and grinders.

ELECTRICAL DEVICES, LTD., 18-20, Collingwood Street, Newcastle-on-Tyne.—A trade price list of radio receiving sets, components, and accessories.

DELCO-REMY & HYATT, LTD., 56, Victoria Street, S.W.1.—A series of illustrated price lists dealing with roller bearings, shafting boxes, hangers and brackets, &c.

MESSRS. L. MCMICHAEL, LTD., Hastings House, Norfolk Street, Strand, W.C.2.—An illustrated and priced folder advertising h.f. transformers and tuning condensers.

THE VICKERS-SPEARING BOILER CO., LTD., 20, Kingsway, W.C.2.—An illustrated catalogue dealing with "Illinois" chain-grate stokers and furnace construction.

THE UNDERFEED STOKER CO., LTD., Aldwych House, Aldwych, W.C.2.—A brochure illustrating and describing the "Murray" fin-tube, water-cooled furnace wall.

MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, W.C.1.—April stock list of d.c. motors.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—April price list of electrical appliances, materials, and accessories.

MESSRS. JOSEPH JACKSON (ASBESTOS), LTD., Canal Yard, Rochdale.—A priced and illustrated leaflet advertising coil holders for radio sets.

MESSRS. COX-WALKERS, Darlington.—A pamphlet illustrating and describing fire alarms, watchmen's indicators, &c.

IMPROVED APPLIANCES, LTD., 43 and 44, Fetter Lane, E.C.4.—Two illustrated folders dealing with the "Safe Economy" electric iron and a grip control switch for this and other electrical appliances.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A mailing card advertising the "Cambridge" thread recorder for temperature, and CO_2 and CO percentages.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Pamphlet No. 234, a well-illustrated technical brochure dealing with "Marconi" portable and military communication sets. Twelve different types are described, and a great deal of information regarding earth and aerial systems, transport, &c., is given. The pamphlet is priced at 10s.

MESSRS. FALK, STADELMANN & CO., LTD., 83-87, Farringdon Road, E.C.1.—A comprehensive catalogue (212 pp.) of lighting fittings, bells, telephones, radio apparatus, &c. Fully illustrated and priced.

THE WESTMINSTER TOOL & ELECTRIC CO., LTD., 116, Putney Bridge Road, S.W.15.—An illustrated booklet dealing with British-made flexible shafts for various purposes.

Copper Prices.—Messrs. F. Smith & Co. report April 7th:—Copper (electrolytic) bars, £64 10s., 5s. decrease; do., do., sheets, no change; do., do., wire rods, £74 10s., 5s. decrease; do., do., h.c. wire, no change. Messrs. James & Shakespeare report, April 8th:—Copper bars (best selected), sheet and rods, no change; English pig lead, £34, 45s. decrease.

Commercial Electrical Travellers.—The second general meeting of the Electrical Trades Commercial Travellers' Association was held at St. Bride Institute, E.C.4, on April 8th.

New Italian Companies.—Two new telephone companies have lately been formed in Italy—the Società Settentrionali Telefoni, Milan, with a capital of 100,000 lire; and the Società Telefonica Turreni, Leghorn, capital 100,000 lire.

A new company has lately been formed in Turin with a capital of 1¼ million lire and the title La Consorzio Industriali per la Produzioni di Energia Elettrica.

Book Notices.—The Queen's Engineering Works Magazine, January, 1925, No. 22. Pp. 62; fully illustrated. Bedford: W. H. Allen, Sons & Co., Ltd.—A most interesting record of the business and social sides of this engineering firm, depicting the outstanding events of the past year. Many excellent contributions on engineering advancement and productions render this magazine of educational value to the engineering profession.

"The *Journal* of the South African Institution of Engineers," March, 1925. Johannesburg: The Institution. Price 2s.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLIV, March, 1925. No. 3. New York: The Institute. $1.

Volume XIX of the Royal Society's *Catalogue of Scientific Papers* will shortly be published by the Cambridge University Press, completing the great work of cataloguing the scientific papers of the nineteenth century.

"Practical Humidity Tables for Engineers, Textile Manufacturers, &c.," compiled by the technical staff of A. B. Cleworth and Co., air conditioning specialists. London: Taylor and Francis. Price 6s. net.

Liverpool Radio Retailers' Association.—Dealers in radio sets and parts at Liverpool are forming a Radio Retailers' Association with the object of facilitating co-operative effort to stabilise the wireless trade. Mr. Geo. Dunbell, of the J.D. Wireless Co., has been elected president, and Mr. F. G. Barraclough vice-president. A committee of seven local retailers has been formed and Mr. J. R. Hall, 36, Townsend Lane, Liverpool, is secretary.

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from April 1st:—

Kango. No. 455,846. Class 6. Electrical percussion machine tools.—Richard Willis W. Kane, 78, Petty France, Westminster, S.W.1.

Gil-Ray crystal (lettering and design). No. 452,575. Class 8. Detector crystals for use in radio-telephony and telegraphy.—A. C. Gilmour, Sicilian House, Southampton Row, W.C.1.

Decko. No. 453,145. Class 8. Apparatus for use in radio-telegraphy and telephony.—A. F. Bulgin, trading as A. F. Bulgin & Co., 9-11, Cursitor Street, E.C.4.

Retrofecta. No. 455,778. Class 8. Instruments and apparatus for use in radio signalling and telephonic instruments.—The Radio Engineering Co., Ltd., 76, Victoria Street, S.W.1.

Microdyne. No. 455,155. Class 8. Apparatus for use in radio-telegraphy and telephony.—Radio Acoustics, Ltd., Peckham Park Road, S.E.15.

Ultrynic. No. 456,410. Class 8. Aerial coupling coils for use in radio-telephonic apparatus.—Igranic Electric Co., Ltd.

Uviation. No. 456,705. Class 11. Instruments and apparatus for use in light-therapy.—Kelvin, Bottomley & Baird, Ltd., Glasgow.

Tête d'Or (lettering and design). No. 453,144. Class 13. Metal clasps, fasteners, catches, &c.—Compagnie Générale d'Electricité, 54, Rue de la Boetie, Paris. (British representatives, Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.2.)

Zonoz. No. 455,434. Class 13. Electric fuses and cut-outs.—Parmiter, Hope and Sugden, Ltd.

Australian Overseas Contracts. — Mr. Pratten, Minister for Customs, referring to the recent placing of large contracts abroad, has declared that attempts to evade the Customs tariff will be checkmated, as it is essential to protect local manufacturers. It is reported that the orders recently placed overseas include a gasholder, steel wireless masts, machinery for railway workshops, and electric transformers.—*Reuter* (Melbourne).

The World Glow Lamp Convention. — A correspondent states that the constitution is reported to have taken place at Geneva of the Phoebus Company with the participation of all the leading makers of glow lamps throughout the world, for the purpose of acting as the administrative department of all the interests concerned. The company will undertake the mediation of the exchange of manufacturing methods and the acquisition of patents, and each member firm is under the obligation to sell the patents obtained, on the request of another member. The chairman of the Phoebus Company is Dr. Meinhardt, of the German Osram Company. Besides the latter all the other German firms interested in the production of glow lamps are said to have now joined the convention, namely, the Bergmann Company, Julius Pintsch and Co., and the Radium Company of Wippersfurth. The other members of the convention comprise the International Electric Company, of the United States, the Dutch firms under the leading of Phillips & Co., and the French makers under the leading of the Compagnie des Lampes, as well as the English, Scandinavian, Italian and Japanese lamp makers. It is stated that the convention will not exercise any influence on the fixing of prices or other conditions of business, the opportunities for competing being left equal in the case of each member.

New French Companies.—Among the new hydro-electric undertakings recently organised in France are the Société du Barrage Sechilienne, formed at Grenoble with a capital of 220,000 fr. to establish a station on the River Romanche at Sechilienne (Isère); the Société Hydro-Electrique de la Diege, Paris, with a capital of 20 million fr., to establish a plant on the River Diege at Roche-le-Peyroux; the Société des Forces Motrices de la Haute Romanche, 25, Rue de la Pepinière, Paris, capital five million francs, to utilise the Romanche and Ferrand Falls near Bourg d'Oisans (Isère); and the Société des Forces Motrices du Vicdessos, 125, Rue de la Boetie, Paris (capital 12 millions), to utilise the Bas Vicdessor Falls near Sabart (Ariege).

The Société Financière pour le Developpement de l'Electricité, of Paris, has been constituted with a capital of 25,000,000 fr. The company has taken over a portion of the holdings of the French Thomson-Houston Company, and proposes to co-operate with important French and American concerns in electrical development.

Under the auspices of a French-Belgian syndicate, a new company has recently been formed in Paris, with a capital of three million francs and the title La Société d'Electricité d'Alep (Syrie), to undertake the supply of electricity for lighting and power purposes at Aleppo, Syria.

Correction.—In the "Figures that Speak" advertisement of Messrs. Blackstone & Co., Ltd. (ELEC. REV., March 27th, p. xvii), some of the figures did not speak as clearly as they might have done. In line 5 it would have been better had "3/8d. per unit" been printed ¾d., because that is, of course, what was meant.

Projected International Exhibition.—According to the *Financial News*, an International Exhibition and Fair is to be held in London next year, and a meeting was recently held in this connection at which a number of Chambers of Commerce and foreign powers were represented.

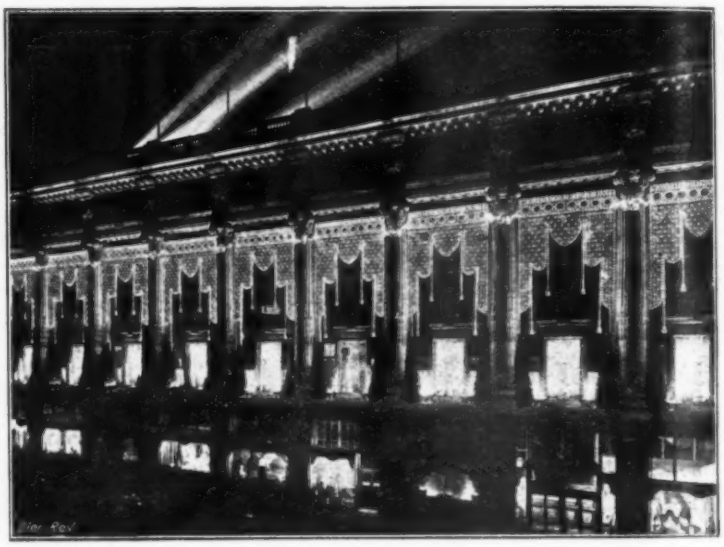
Engineering Exhibition at Dartford.—Under the auspices of the North Kent Local Section of the Junior Institution of Engineers, an interesting exhibition of machinery, tools, and models was held at Dartford on March 21st in the dining hall of Messrs. J. & E. Hall, Ltd., to afford engineering firms in the district an opportunity of displaying their productions to local residents and to emphasise the importance of the local engineering industry. Neither exhibitors nor visitors were slow to take advantage of the facilities offered. Representative exhibits were made by Messrs. J. & E. Hall, Ltd., Vickers, Ltd., Johnson & Phillips, Callender's Cable Co., Aveling and Porter, Ltd., Fraser & Chalmers, Elliott Bros., Ltd., the Pitter Gauge Co., Heath & Co., and the South Suburban Gas Co.

Lantern Slides.—The Vickers-Spearing Boiler Co., Ltd., 20, Kingsway, London, W.C.2, has a set of lantern slides illustrating various types of water-tube boilers and chain-grate stokers, which it will be pleased to lend to lecturers.

Special Lighting at Selfridge's. — In connection with the recent "birthday celebrations" at the large establishment of Messrs. Selfridge, Ltd., Oxford Street, the whole of the main façade has been specially illuminated for two or three weeks. The accompanying picture shows the nature of this decorative lighting. Each of the "curtains" shown is 16 ft. wide and 21.5 ft. high, and is of gilded wood. The illumination consists of "Fairyland" strip with watertight holders, the m.f. lamps being rated at 14 V, 3 W, and fitted with little gilt reflectors. The total number of lamps in these curtains is about 15,000; they are spaced at intervals of from 6 to 12 inches. The garlands around the capitals are composed of variegated foliage and "Fairyland" strip, the lamps in these cases being of the 240-V, 40-W traction type in assorted colours. The interior illumination consists of 10,000 14-V, 3-W lamps made up into sprays and festoons, supported by 80 life-size plaster figures. The scheme was carried out by Implitico, Ltd. (the Imperial Lighting Co.).

The decorations are to remain in position until April 17th, when they will be sold by the firm which installed them.

It may be of interest to our readers if we point out that the aerial mast of the new 2LO station can be seen upon the roof of the building, partly illuminated by the beams of light.



Special Lighting at Selfridge's.

Threatened Lock-out in Belgium.—In response to the threat of their employés to strike on April 15th, the iron manufacturers of Hainault announce a general lock-out in the metallurgical industries of Hainault, to begin on April 16th.—*Reuter* (Brussels).

Tramways and Omnibuses.—In the course of his speech at the recent annual meeting of the shareholders of the British Automobile Traction Co., Ltd., Mr. Leo M. Myers said that much had been heard about the heavy charges for road maintenance which tramways had to meet in respect of roads which were also used by competing and other traffic. While the matter could be viewed sympathetically, it should not be forgotten that omnibuses were taxed for the privilege of using the roads to the extent of from £60 to £84 per vehicle per annum. Referring to the complaints by municipalities of motor omnibus competition with tramways in the centre of their areas, Mr. Myers said he thought that it was essential for omnibuses to run right into the towns and not be compelled to transfer their passengers to tramcars at the boundaries. It was false to say that private omnibus companies paid nothing for road upkeep; in the case of their group the annual contribution was about £100,000.

German Diesel Plant for British Ships. — In connection with the five motor ships which have been ordered from the Deutsche Werft for English account, it is stated that the A.E.G., Berlin, will supply ten Diesel engines of 3,800 h.p. and 15 dynamos with oil engines of 135 h.p. All the auxiliary machinery for the ships and main engines will be electrically driven.

Unemployment.—The returns of the Employment Exchanges dated March 23rd showed a total of 1,201,300 unemployed persons. This was 17,900 less than a week earlier, but 137,780 more than at the same period of 1924.

Poor Prospects in South Africa.—In a letter to hand this week from a well-known electrical engineer in South Africa, the writer says:—"The prospects for Home engineers looking for vacancies out here are, in my opinion, rather poor. There are many able men in the country holding billets far beneath their capabilities, and more than that, as Universities are now established in South Africa, the training young men receive naturally fits them for the various vacancies occurring in the country. As a result of this training there are plenty of men available."

Egyptian Contract for British Firm.—The Cairo correspondent of *The Times* reports that the Metropolitan Carriage, Waggon & Finance Co. has secured a contract from the Egyptian State Railways for the supply of 500 box trucks. Early delivery was a decisive factor in the adjudication, since several other firms, notably German and Czecho-Slovak, put in lower tenders, but the British company offered to begin delivery in ten weeks at the rate of 60 a week. A Czecho-Slovak firm also received a contract for a further 500 trucks.

Fire.—On April 1st a fire at the steel works of Messrs. Jonas & Colver, Ltd., Attercliffe, Yorks., destroyed a wooden structure used as an electrical sub-station. The damage amounted to several hundred pounds.

Australian-made Radio Valves.—In February last Australian manufacturers of thermionic valves applied to the Tariff Board for the imposition of a special duty on imported valves. An inquiry was held by the Board, and strong opposition was put forward by the Electrical Employers' Association and users of radio valves, on the ground that the applicant company was not in a position to produce the range or quantity of valves required by Australians. The Board's decision has not yet come to hand.

Chinese Note.—The *Chinese Economic Bulletin* reports that the Kwangtung Tramway Co., which was incorporated in Hong-Kong to undertake the building and management of a tramway system in Canton, is to be reorganised. It is proposed to increase the capital by $1,000,000 in 100,000 shares of $10, and to redeem the old shares at 50 per cent. of their face value or to allot one new share for two old shares. The company has built a power house and central depôt, but so far has laid none of the track. It has operated motor-buses for some time over the route, but without much success.

Danzig Water-power Scheme.—In an interview with a representative of the *Financial News* recently, Dr. Volkmann, Finance Minister of the Free City of Danzig, referred to the imminent issue of £1,500,000 of 7 per cent. mortgage bonds by the City Government. He said that the bulk of this loan would be spent on the completion of the Radaune hydro-electric scheme. Owing to the increase in the population of the city, as well as the attachment by the Treaty of territories which formerly obtained their supply from Eastern Prussia, the extension of the electrical system has become necessary, and the work has already made substantial progress. The utilisation of the Radaune waterfalls will enable the city to reduce its coal imports.

New Municipal Showrooms and Offices.—The showroom and new offices recently acquired by the Stoke-on-Trent Electricity Department were formally opened by the Mayor on March 30th, in the presence of a large gathering of the public and representatives of electrical contractors and manufacturers. The new premises consist of a block of three storeys with five rooms on each floor. The showroom is equipped with many styles of lighting fittings and the whole range of domestic appliances.

The Birkenhead Corporation Electricity Committee has decided to purchase premises in Grange Road West for £5,000 for use as a showroom, and adaptation and equipment will cost £1,000.

An Illuminated Sign Association.—An Association of Users and Manufacturers of and Traders in Illuminated Signs has been formed, with offices at 25, Victoria Street, S.W.1. "to watch the proceedings of Parliament and Government Departments for the purpose of protecting the interests of its members against restrictive legislation; to safeguard those interests against excessive rating and prohibitive by-laws proposed by local authorities; and to take action in matters of a legal character in which its members may be involved within the functions of the Association."

Strike at Manchester.—On the night of April 7th about 100 electricians employed by the Manchester and Salford tramways upon maintenance work decided to cease work to enforce a demand for an increase of 14s. 10d. per week in their wages.

The Census of Production.—The *Board of Trade Journal*, dated April 2nd, contains an article which comments in a helpful manner upon a number of points which will have to be observed by manufacturers in completing the forms which are now being circulated to them in connection with the Census of Production. It points out that it is intended to group the information gathered under ten sub-divisions of the country instead of merely giving it as an aggregate for England and Wales, Scotland, and Ireland. This means that manufacturers with more than one branch will have to furnish separate particulars of each branch if these are in different districts. The information with regard to manufactures is required in greater detail, much of which will be of assistance to trade organisations, who, in fact, have asked for these extra details. The method of valuing output is briefly considered, and distinction is made between goods sold direct to consumers and those supplied to factors. Fuel, gas and electricity are to be included among the "materials" used in production. The statement of the number of employés is to be amplified by monthly figures for the year covered. Separate figures of the power generated by steam engines and other prime movers, and of the power which is applied electrically are required. It is considered that these "will furnish valuable indications of the degree in which the general tendency to the greater use of electricity for industrial purposes has affected manufacture in this country. Very remarkable changes have taken place in some other countries, and it will be of interest to measure the changes in our own industry."

The article concludes with an appeal to manufacturers to complete and return the forms as quickly as possible to facilitate a speedy publication of the results.

The British Empire Exhibition, 1925.—Judging by a brochure which has been received from the Exhibition authorities, a big effort is being made to render this year's display more attractive even than the original Exhibition. The excellent lighting scheme which was described in a recent issue of the ELECTRICAL REVIEW is only one of the new features. The Dominions and Colonies are all brightening up their displays, and electric lighting and effects will be employed to a very large extent. The Post Office exhibit is being enlarged, and in the Palace of Engineering, which will be somewhat different in appearance this year, all-electric and all-gas houses are among the new exhibits. The Civic Hall will be occupied again by municipal authorities—each for a certain period, and the catering question appears to have been settled in a satisfactory manner.

It was officially announced last week that the Exhibition would be opened on May 6th.

Social Event.—The Electricity Supply Commercial Association held a successful dance on March 31st at the Imperial Hotel, Russell Square, W.C.1. It is true that the 250 members and friends present were at times pressed for space, but the spirit of *camaraderie* that prevailed made light of this slight discomfort. The Adams Syncopaten Orchestra was equal to the demands made on it, and the catering was excellent. The secretary, Mr. G. R. Smith, and those who assisted him, are to be congratulated for organising a very enjoyable evening.

Works Closing.—With reference to our paragraph (ELEC. REV., March 27th, p. 496) quoted from the *Financial Times* respecting the closing of the works of Messrs. Richardsons, Westgarth & Co., we learn from the company that this is erroneous. We have pleasure in giving publicity to the following correct statement of the matter:—As a result of the very severe depression in the marine engineering industry, the Middlesbrough works of the company will shortly be closed down, and such orders as are obtainable will be executed at the Hartlepool works of the firm. The company have, accordingly, with great reluctance, issued a notification that it may be impossible to retain the services of the whole of the staff at the Middlesbrough works for longer than another month. A small number of officials will, however, be retained to deal with any inquiries or business which may come forward. At present there is only a small number of workmen employed, these being engaged on repair jobs, the last vessel to be engined at the Middlesbrough works having gone to sea a week or two ago. The staff, including draughtsmen, clerks, foremen, &c., numbers about 50.

Vickers in Rumania.—The *Financial News* states that a new company called the Copsa Mica and Metallurgical Works is being formed in Rumania, with the participation of the Rumanian Government and Messrs. Vickers, Ltd. The initial capital will be 300 million lei, but the board will be authorised to raise it to 1,200 million lei. Of the initial capital the public will be offered 90 million lei, while the balance will be allotted to the Government, the Resitza Works, and Vickers, Ltd., for various contributions in kind. The Government will contribute the estate on which the factory is to be erected, the use of the Cujir hydro-electric works, and certain machinery, while the two companies will also furnish machinery. The works will undertake the production of armaments and commercial machinery.

Engineering Employés' Wages.—The first meeting of the joint committee of representatives of the Engineering Employers' Federation and engineering trade unions was held on March 31st. The employers then gave fuller details regarding their desire for the removal of the restrictions which at present are said to hamper production, and the men's representatives intimated that it would be necessary for them to consult their union executives upon the attitude to be adopted by them. A meeting of the men's representatives took place on the following day, when it was decided that the consultation with the union executives should take place after Easter.

For Sale.—Aldershot Gas, Water, and District Lighting Co. invites offers for gas engine generating plant. Wolverhampton Corporation Electricity Department invites offers for one 4,000-kW and one 2,000-kW turbo-alternators, condensers, auxiliaries, &c., two 3,000-amp. battery boosters. (See our advertisement pages to-day.)

United States Electrical Exports.—As we have already reported, the total value of electrical goods and apparatus exported from the United States during 1924 was over $82,000,000, as compared with $71,647,000 in 1923 and $63,119,000 in 1922.

In a detailed analysis of these figures, *Commerce Reports* shows that the increase was due to the expansion in business during the first half of 1924; in the latter half there was a marked falling-off in all branches. The downward trend is attributed to the domestic demand and to increased European competition. Shipments to Europe as a whole decreased, although Canada, South Africa, Australia, and New Zealand purchased more. Among the more notable increases in 1924 may be mentioned radio apparatus, which rose in value from $3,500,000 to over $6,000,000; self-contained lighting outfits which have increased by 54 per cent. in each of the two past years; domestic appliances, which again showed an increase of about 27 per cent.; and telephone switchboards, which were valued at nearly three times the 1923 figure.

The total value of electrical goods exported from the United States in January last was $7,493,501. This was lower than the value recorded in January, 1924, but higher than the December shipments and last year's monthly average. Increases were shown by large a.c. generators, steam turbo-generators, electric locomotives, and radio apparatus. Exports of the last item were more than double those of January, 1924. There were decreases in the exports of large d.c. generators, electric motors, and insulated wire and cable.

Radio Publicity.—The Mullard Radio Valve Co., Ltd., has produced a film entitled "Hearing's Believing," which is being shown at all the principal kinemas throughout the country. When the film was exhibited at Bath recently a local dealer, Mr. A. W. Young, took advantage of the opportunity offered by securing permission to erect a stand displaying "Mullard" valves, &c., in the entrance hall of the Assembly Rooms during the "run" of the film.

The Rutenberg Concession.—A *Daily Mail* correspondent states that the International Court of Justice at The Hague has delivered its judgment in the action of the Greek Government against the British Government. The former Government claimed that a Greek citizen, M. Mavromatis, held a prior concession to that granted to Rutenberg in respect of public works in Palestine, including electrical undertakings. The Court finds that the Mavromatis confession is valid, and that the British Government had no right to expropriate it in favour of Rutenberg.

Lighting and Power Notes.

Bedworth.—STREET LIGHTING.—The local Council has accepted the offer of the Leicestershire and Warwickshire Electric Power Co., Ltd., for public lighting by 116 lamps, at £4 2s. 6d. per lamp per annum.

Birmingham.—ELECTRICITY EXTENSIONS.—The Corporation Electric Supply Committee has recommended to the City Council an expenditure of £240,000 on the general extension of mains and £60,000 on trunk feeders. In June last the Committee obtained authority to incur an expenditure of £200,000 on general extensions of mains, practically the whole of which has now been expended. A recent report stated that the past year had been one of exceptional activity in coupling up new consumers, particularly in the outer districts. About 5,500 consumers had been added, representing an addition of 12,500 kW to the load connected to the undertaking, which now stands at 102,350 kW. In order to meet the extra demand and maintain adequate pressure of supply next winter, it was necessary to put down a number of trunk mains, feeders, and distributors, which involved an expenditure of £134,000. A survey of the department's capital requirements, including the £134,000, and the normal expansion of the distribution system, showed that a total sum of £300,000 would be required to March 31st, 1926. This estimate included provision at a cost of £60,000 for 33,000-V trunk mains between Nechells and Bournville, Summer Lane, and Hay Mills, respectively. Those trunk mains were required in order to make available at the centres of demand the additional energy now being generated at the Prince's station, Nechells. Interest and sinking fund charges on £300,000 of extra capital would amount to about £22,500 per annum, but it was estimated that the additional gross revenue would amount to about £130,000 per annum.

Blackburn.—ELECTRICITY SUPPLY.—The Town Council, on April 2nd, approved an estimate, amounting to £42,000, for laying the Blackburn portion of the interconnecting 33,000-V

transmission main between the Jubilee Street distributing station and the Ribble (Preston) power station. Application is to be made for necessary borrowing powers. The work is being carried out by the British Insulated & Helsby Cables, Ltd., of Prescot.

Blackpool.—Electricity Agreement.—An agreement has been reached between the Corporation and the Thornton Council regarding the terms for a bulk supply of electricity to Thornton.

New Plant.—Application is being made for sanction to a loan of £25,500 for the installation of two new boilers and accessories at the electricity works.

Brighton.—New Plant.—The Lighting Committee has authorised the borough electrical engineer to purchase a turbo-alternator at a cost of £22,020, and a surface condenser at a cost of £6,640.

Continental.—Finland.—Good progress is being made with the construction of the hydro-electric station which is being established in Finland to utilise the Imatra falls. Three Francis-type single-wheel vertical turbines of 27,000 h.p. have already been installed. When completed, the plant will comprise eight turbo-alternators.

Austria.—A *Reuter* message from Vienna states that the President, Dr. Hainisch, the Chancellor, and the General Commissioner for the League of Nations attended the opening of the hydro-electric works at Teigitsch, near Gratz, on March 28th, which have been constructed largely with the aid of foreign capital, and will have an output of 24,000 h.p. The energy generated will be distributed to many important industrial concerns.

Belgium.—Good progress is being made with the construction of a new power station at Farciennes by the Société de Gaz et d'Electricité du Hainaut. The plant will have a capacity of 18,000 kW. When this is completed the company will have power stations with a total capacity of 85,100 kW.

Coventry.—Gas Works Plant.—The Corporation is to install a 64-kW generating set and switchboard at the gas works, at an estimated cost of £2,200.

Croydon.—Electricity Extensions.—The Electricity Committee has recommended extensions of mains at a cost of £5,389, and the renewal of the l.p. feeder cable from the electricity works to the centre of the town, at a cost of £2,700.

Criccieth. — Electricity Supply. — The Urban District Council has decided to examine the electricity schemes of the General Electricity Co., and the Gwynedd Trust, following a complaint at a recent meeting that the Gwynedd Trust proposed to include only half the town in the compulsory area. It was suggested to the Council that unless an electricity supply was available by a certain date the Council should proceed with a scheme of its own

Doncaster.—Electricity Extensions.—The Town Council has adopted a recommendation by the Electricity and Tramways Committee that application be made for sanction to borrow £21,800 for new h.p. mains, sub-stations, and l.p. feeders, and £24,750 for mains, services, and meters, to meet the anticipated developments during the next two years.

Dover.—Loans Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £1,400 for mains and £600 for building work and sub-station equipment.

East Preston.—Special Order.—The Rural District Council is applying for a Special Order to supply electricity throughout its area. The Sussex Electric Supply Co., Ltd., has withdrawn this area from its application for a similar Order.

East Sussex.—Special Order.—Application has been made to the Electricity Commissioners by Messrs. Crompton & Co., for a Special Order authorising them to supply electricity in the urban districts of Seaford and Newhaven, and certain parishes in the rural districts of Newhaven, Chailey and Eastbourne.

Guildford.—Loan Sanctioned.—The Town Council has received sanction to the borrowing of £6,250 for the purchase of land in Woodbridge Road, as a site for the new power station.

Hitchin.—Opposition Withdrawn.—The Rural District Council has rescinded its former resolution not to permit the use of overhead cables by the North Metropolitan Electric Power Supply Co., Ltd., for the purpose of supplying electricity in the district. The company pointed out to the Council that overhead mains would cost only £1,500 a mile, half the cost of underground cables.

Ilford.—Loan.—The Urban District Council is applying for sanction to the following loans:—Goodmayes sub-station.—Land, building, showroom, two 500-kW rotary converters and switch cubicles, £8,400. Uphall Road sub-station.—One 1,000-kW "La Cour" motor converter, switch cubicles, &c., £4,000.

Electricity in Bulk.—The Electricity Committee has recommended that the chairman and the electrical engineer be instructed to interview the Electricity Commissioners with further reference to the question of a bulk supply of electricity to the Council's electricity undertaking.

Irish Free State.—The electricity undertaking of the Enniskerry Electric Light Co. was formally inaugurated by Viscountess Powerscourt on April 3rd.

Japan.—Tokio.—It is reported that the Tokyo Electric Light Co. is to erect a 55,000-V transmission system 35 miles in length connecting its power station at Inawashira with the power station of the Fukushima Electric Light Co., to carry a new 3,000-kW load. The latter company has been negotiating for a supply, as the demand in its area now exceeds the capacity of its power station.

London.—St. Marylebone.—The Borough Council has received sanction to the borrowing of £39,000 for new plant.

Oldham.—New Power Station.—The Corporation is purchasing 33 acres near Middleton Junction for the erection of a new generating station.

Plymouth.—Mains Extensions.—The Electricity Committee has decided to lay cables in Paisley Street East at a cost of £1,089, and in Millbay Docks at a cost of £2,092.

Preesall.—Special Order.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Urban District Council to supply electricity in the urban district.

Preston.—Electricity Supply.—It was reported at a recent meeting of the Town Council that a further £150,000 is to be spent on the completion of the electricity undertaking.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Shrewsbury.—The percentage increase from 25 to 12½.

Glossop.—*The Urban Electric Supply Co.*—Power: First 100 kWh per quarter, 7d. per kWh; next 3,000 kWh, 4d.; next 15,000 kWh, 2½d.; all energy in excess, 2d. per kWh.

Darlington.—Lighting: 2d. per kWh from March 1st to October 31st, instead of six months as formerly, for an equal number of kWh used in the remaining four months, 2d. per kWh, and for all additional energy, 3½d. per kWh. Cooking and heating: From ½d. to ¾d. per kWh from March 1st to October 31st, and the same charge for an equal amount of energy from October to February, with 1½d. per kWh for all additional kWh.

Nottingham.—Lighting: A reduction of ½d. per kWh. Power: Maximum demand rate, £8 10s. per kW per annum, plus 0.45d. per kWh. Power supplied to Tramways Department: A reduction of ½d. per kWh.

Stirling.—Lighting: From 6d. to 5d. per kWh.

Shrewsbury.—Rate Relief.—The Lighting Committee has allocated £1,000 from the profits of the electricity undertaking towards the relief of the rates.

Sittingbourne.—Electricity Scheme.—The Urban District Council has been asked to support an application by Major Prescott-Westcar, of Herne, for a Special Order to supply electricity in its area. It is proposed to obtain electricity in bulk from the Kent Electric Power Co., to use underground mains in the central parts of the town, and overhead mains in the outlying parts. The Council has referred the application to the Clerk for further inquiries.

Stoke.—Loan Sanctioned.—The Electricity Commissioners have sanctioned a loan of £2,400 for mains in the Hanley district.

Electricity in Bulk.—The Electricity Committee is negotiating for a bulk supply to the Madeley and Parkhurst Collieries.

West Scotland. — Interconnection Scheme. — Valuable records of results have recently been obtained regarding the possibility of effecting economies in production by experiments carried out in the linking-up of municipal power stations in the West of Scotland. The four stations at Ayr, Kilmarnock, Paisley, and Greenock were linked together by overhead transmission lines, and interchange of electric supplies took place throughout the group for several hours. Thereafter experiments were carried out for supplying the whole West of Scotland area from each station in turn. The trials are reported to have been satisfactory.

Wirral.—Electricity Scheme.—It is anticipated that a start will be made on the Wirral electricity scheme within the next three months and that the work will be almost completed by the end of the year. The central point in the scheme will be Ellesmere Port. Overhead cables with a voltage of 33,000 will convey the energy to Eastham, where it will be reduced to 11,000 V. Transformer stations will be built at Hooton, Willaston, Little Sutton, Little Neston, Heswall, Neston and Parkgate, Thurstaston, Gayton, with a branch line through to Grange. Each of the sub-stations will transform the pressure down to 440 V for power and 250 V for lighting purposes.

Tramway and Railway Notes.

Blackpool.—New Cars.—The Corporation has received sanction to borrow £10,500 for the purchase of six new tramcars, and £7,500 for five new motor-omnibuses.

Bolton.—Track Renewals.—The Tramways Committee has decided to carry out the relaying of the Town Circle track at an early date.

Continental.—Spain.—It is reported that three miles of the track of the Sarria electric railway, leading to the terminus in Barcelona, is to be converted into a subway.

France.—The report of the Paris-Orleans Railway Co. states that during 1924 the repairing shops in the plain of Vitry-sur-Seine were completed, 12 sub-stations or transforming posts

were established, and the overhead line was completed between Bretigny and Dourdan, and is in course of erection between Paris and Vierzon. Although some delay has taken place in the work of electrification of the network, electric locomotives and new motor coaches are already in service on the sections of Austerlitz-Juvisy and Bretigny-Dourdan. The delivery of further locomotives and motor coaches is expected to take place this year.

SWITZERLAND.—It is reported from Berne that tenders are about to be invited for the electrification of the railway along the right bank of Lake Geneva, and that the work is to be completed by the middle of 1926.

The Swiss Federal Railway authorities are to erect three new sub-stations, one with a capacity of 18,000 kVA and two of 27,000 kVA each. Contracts for the plant have been placed with Swiss firms.

DENMARK.—It is reported that the Danish State Railway authorities are considering the question of electrifying the railways serving the Copenhagen suburban area. Both a German and an English syndicate are stated to have submitted schemes.

POLAND.—The Polish Government has recently granted a concession for the construction of an electric railway between Warsaw and Zyrardow. It is also proposed to construct an electric tramway between the two towns.

BELGIUM.—Work is in hand in connection with extensions of the Charleroi-Montigny, Charleroi-Couillet, and Charleroi-Gilly lines of the Société des Tramways Electriques du Pays de Charleroi et Extensions.

Croydon.—RAILLESS CARS.—The Tramways Committee has recommended the purchase of 14 railless cars for the Addiscombe Road route, the preparation of plans for a depôt in Morland Road, and estimates for the overhead equipment, &c.

Fleetwood.—NEW TRACK.—The Blackpool Corporation has decided to extend the tramways from the present terminus in North Albert Street, Fleetwood, by a loop, a quarter of a mile long, which will run along the promenade, joining up with the line in the main street.

Halifax.—FARES.—The Corporation has reduced the fares on its tramways by approximately 25 per cent. The 2d. fares have been reduced to 1½d., and the 1d. stages have been extended to about three-quarters the distance of a 1½d. stage. The system of pre-booking, by which tickets valued at 1s. 2d. were sold for 1s., has been withdrawn.

London.—TUBE FARES.—Reduced fares for long-distance traffic have been introduced on the Underground Railways. Within an area bounded by Hendon (Central), Highgate, and Finsbury Park on the north, Clapham Common on the south, Liverpool Street and Mansion House on the east, and Hammersmith on the west, the maximum fare for any journey will be 6d. The Metropolitan Railway has introduced seven-day third class season tickets between certain stations on its system.

AUTOMATIC TRAIN INDICATORS FOR THE TUBES.—The Underground Company is installing a complete system of automatic indicators on the Hampstead and City group of railways in order to provide adequate means of advising passengers of the movement of the trains and to facilitate the operation of trains on completion of the Kennington and Morden Tube extensions which are now under way. The system will be similar to that which has proved satisfactory on the District Railway. Platform signs of the illuminated box pattern will be provided at many stations, and 15 signal cabins will be equipped with automatic indicator box diagrams which will be controlled from the signalling system. Work has begun, and it is hoped to have the whole of the signs in use by the end of this year.

SOUTHWARK BRIDGE TRAMWAY.—It is stated that the construction of the new tramway track over Southwark Bridge will be completed and the line opened for traffic in July next.

Newcastle-on-Tyne.—MOTOR-'BUSES.—The Transport and Electricity Committee has recommended the City Council to purchase 18 additional motor-'buses, at a cost of £20,211, to cope with the demand for increased services.

Rochdale.—ACCIDENT.—A collision occurred on April 6th between a tramcar and a steam wagon. The wagon crashed into the car, dislocating the control box. The car ran backwards down a steep gradient, left the track and ran into shop fronts. Thirty passengers were injured, 11 of them being detained at the infirmary.

Southern Railway.—BREAKDOWN.—Coincident with the inauguration of the new augmented electrical service from Victoria to Sutton and Coulsdon North, an electrical fault occurred at 8.30 a.m. on the Southern Railway, and resulted in considerable delay to traffic during the "rush" hours, the whole of the railway's electrical services being affected. According to a statement issued by Sir Philip Dawson, consulting engineer to the Brighton Section, the cause was a temporary short circuit which tripped the circuit breakers in the power supply circuit. Their setting had been arranged for the old services, and had not been sufficiently corrected for the increased load of the new service. Nothing broke; there was about 40 minutes' delay while the readjustments were made.

Telegraph and Telephone Notes.

German-American Cable Communication.—COMPROMISE REACHED.—The negotiations between the German Postal authorities and the Deutsche-Atlantische Telegrafen Co. on the one hand, and the Commercial Cable and Western Union Telegraph Companies on the other, with a view to hastening the re-establishment of direct cable communication between Germany and the United States, have come to a conclusion. Under the new agreement the German company will handle the entire cable traffic of both the American companies to and from Germany between Emden and the Azores, while the traffic from the Azores to America will be under the administration of both the American companies. In order to finance the construction of the cable between Emden and the Azores, the New York bankers, Harriman & Co., in 1922 promised a 20-years' loan of four million dollars at 7 per cent. to the German company. The necessary permission to land a cable at the Azores has already been granted by the Portuguese Government. At a meeting of the board of directors of the Deutsch-atlantische Company on March 31st, it was decided to "fold up" the company's paper mark capital at the rate of twenty to three, so that the company's gold mark capital will be six and a-quarter millions.—*Reuter* (Berlin).

According to *The Times*, the Neue Deutsche Kabel-Gesellschaft, which had been formed under the leadership of Warburg and Co., of Hamburg, to construct the Emden-Azores cable, is being absorbed by the Deutsche Atlantische Telegraphen-Gesellschaft.

Germany.—RAILWAY TELEPHONY.—A new company has lately been formed in Berlin with a capital of nine million gold marks (about £450,000) and the title of the Zug Telephonie Gesellschaft, to carry through agreements made by the Dr. Erich F. Huth Co. with the German State Railway and Post Office authorities with regard to the establishment of telephonic communication between trains and telephone exchanges. It is expected that the system will be in operation on the express trains running between Berlin and Hamburg by June next, and that later the Berlin-Munich trains will be similarly fitted.

International Telephony.—G.P.O. TESTS.—During recent weeks Post Office officials have been making experiments which it is hoped will shortly lead to a telephonic system which will unite London with every great city in Europe and Asia. The *Morning Post* was informed at the General Post Office that an engineer on the staff had made three tests which are the forerunners of the new inter-European service. The first was between London and Stockholm, the second between London and Turin, and the third between London and Berlin. A call has never been put through before between these points. All three proved entirely successful. It is hoped that communication with Rome will be possible in a few days. The hardest test was the London to Stockholm call, well over 1,500 miles, as it entailed the use of two submarine cables and three land cables. Every stage along the route was warned, and communication was established *via* Amsterdam and Hamburg, then across the Baltic to Målmo, and thence by land cable to Stockholm. The result was fairly easy conversation with the exchange at Stockholm, but poor results when the exchange switched on to a subscriber.

If a second test, which will be made in about a fortnight, between London and Stockholm proves that improvements which have been suggested by the Post Office have been made, a regular night service will be begun between the two cities. This will be followed by services between London, Berlin, Rome, and other cities as soon as these experiments meet with equal success. This achievement is the result of Mr. F. Gill's I.E.E. paper in 1922, and it is announced that the second international conference on the subject will be held in Paris on June 22nd, when the reports of the Committee's Consultatif International will be considered.

The Telephone Service.—CABLE TUNNEL.—On account of the difficulty which has been experienced in finding room to lay telephone and telegraph cables under the main streets of London, it has recently been necessary to dig below the water-bearing strata into the London clay. As the services increase, the problem will naturally become more complicated, and it has therefore been decided to construct a steel-lined tunnel 6½ ft. in diameter from the top of Wood Street to Finsbury to accommodate the important cables. Work has commenced, and as the need grows it will be continued until every part of the congested City area is dealt with in a similar way.

United States.—CARRIER-CURRENT SIGNALLING.—The development of a carrier-current system whereby trains may be operated, switches thrown, and passengers talked to directly, all from one central control office, was recently described in an address before the New York Railroad Club by Mr. G. T. Allen, of the Radio Department of the Westinghouse Electric and Manufacturing Co., who prophesied that the system would have a great bearing on the development of electric power and railroad industries in the near future. Mr. C. A. Boddie, of the Westinghouse Co., has, said Mr. Allen, succeeded in combining the automatic telephone and radio arts into a wireless telephone system that has worked "with remarkable perfection on a rather extended power system for over a year."—*Reuter* (New York).

Radio Notes.

Jugo-Slavia.—NEW STATIONS.—Radio is developing in Jugo-Slavia, three stations of fair size being already in operation. They are situated at Belgrade, Serajevo, and Rakovitza. The installation (20 kW) in the capital is used for international service, mainly with Paris, Lyons, Cracow, Prague, and Rome, as also is that at Sarajevo, which is only of 10 kW capacity. Every evening the former broadcasts political and trade news to all European stations and, in addition, there are two small stations at Kotor and Skoplje, but there is a demand for further facilities generally. Consequently, plant for six new stations has been ordered from Germany on reparation account and will be erected at Ljubljana, Zagreb, Split, Pedgoritza, Novi Sad, and Skoplje.

London's Station.—THE 2LO AERIAL.—The permanent change-over from the old aerial of 2LO on the roof of Marconi House to the new one in Oxford Street took place on April 6th. The results of tests show that quite 90 per cent. of listeners in London are getting stronger signals from the new aerial than they did from the old one, while the extended range of the station has brought additional people into effective crystal range of the station, says the *Evening News*. Some people are getting slightly weaker signals from the Oxford Street station, and in such cases the B.B.C. advises that listeners should improve their own aerials. Further tests are to be made, while, in addition to the copper "petticoat" arrangement round the masts, a "feeder" aerial is to be tried; both aerials will oscillate simultaneously and thus increase the radiation.

Parliamentary Broadcasting.—CABINET'S DECISION.—The Cabinet has decided not to proceed further with the idea of a Select Committee of the two Houses to inquire into the question of broadcasting the proceedings of Parliament. According to *The Times*, inquiries did not convince the Government that there was any strong demand for the innovation. The Prime Minister has accordingly decided that, having regard to the fact that the Government intends to review the whole position of broadcasting next winter, he will postpone the special question until the general question is examined.

Radio Union.—GENEVA CONFERENCE.—An international conference of the principal wireless undertakings of Europe took place at Geneva on April 3rd and, according to *The Times*, it has been decided to found at Geneva a union of broadcasting undertakings, with an international bureau, whose duties will be to centralise endeavours at collaboration between the different European stations.

Safety of Aerials.—BILL.—In the House of Commons on March 20th a second reading without a division was accorded to a Public Health Bill, sponsored by Mr. Womersley, which aims at extending to all local authorities certain powers already obtained by some of them through private Bills, thus saving in future the expense of the promotion of such Bills in separate cases. The varied powers covered by the Bill include such matters as the provision of regulations to prevent danger arising from wireless aerials.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdeen.—April 29th. Electricity Department. Four water-tube boilers, with superheaters, economisers, draught fans, steel chimneys, piping, and accessories; also dismantling and re-erecting certain existing boilers. (March 27th.)

Australia.—SYDNEY.—June 4th (extended from May 14th). Postmaster-General's Department. Accumulator and counter e.m.f. cell batteries.*

June 11th. Motor-generator sets for the Randwick, Waverley, Gordon, and City East telephone exchanges.*

MELBOURNE.—May 6th. Victoria Government Railways. High-speed turbine lathe, portable petrol engine-driven electric welding plant.*

Belgium. — April 24th. Permanent Deputation of the Province of Limbourg. Static and potential transformers.*

Carlisle.—April 27th. Electricity Department. Steam, feed, blow-out and other steel pipework. (See this issue.)

Chile.—SANTIAGO.—July 1st. Ports Commission. Eight electrically-operated travelling portal cranes for the Port of San Antonio.*

Dundee.—April 24th. Electricity Department. E.h.p. and l.p. cable. (See this issue.)

Edinburgh.—April 13th. Electricity Supply Department. Underground insulated cables, conduits, pavement box frames and covers, house service fuse boxes. (April 3rd.)

Finland.—HELSINGFORS.—June 1st. Finnish Water Power Department. Two 75-ton overhead travelling cranes, electrically operated.*

Gravesend.—April 20th. Electricity Department. 5,000-kW turbo-generator, condensing plant, switchgear, and straight-tube water-tube boiler. (March 27th.)

Glasgow.—April 14th. Lighting Department. Material, including electrical fittings and accessories for 12 months. Particulars from Lighting Department, 20, Trongate.

Parish Council and District Board of Control. Electrical fittings, &c., for six months. Particulars from Mr. M. A. Reynard, inspector, 266, George Street, Glasgow.

Hindley.—April 27th. U.D.C. Platt Bridge Low Level Sewerage Scheme. Electric motors, pumps, &c. Particulars from O. P. Abbott, Surveyor, Council Offices.

India.—April 17th. India Store Department. Gutta-percha cable. (April 3rd.)

April 21st. Motor converters. April 28th. Electric ceiling fans. April 30th. Porcelain insulator cups. May 5th. 150-kVA steam-driven alternator sets, a.c. and d.c. switchboard for power station. (See this issue.)

BOMBAY.—April 20th. Bombay, Baroda, and Central India Railway. Supply of cables. (March 27th.)

Letterkenny (Co. Donegal).—April 13th. Tirconaill Mental Hospital. Oil-engine-driven generator, switchboard battery, electrical wiring of buildings, &c. (April 3rd.)

London.—H.M. OFFICE OF WORKS.—April 24th. Supply of mechanical and electrical engineering labour during three years in Leeds, Newcastle, and Southampton. (April 3rd.)

METROPOLITAN ASYLUMS BOARD.—April 22nd. Leavesden Mental Hospital, King's Langley. Installation of four new Lancashire boilers, economiser, brickwork settings, laundry machinery and plant, electrical generating plant, motors and power wiring. April 27th. General engineering work, including steam plant, steam and condensing mains, heating and h.w.s. mains and apparatus, electric motors for deep well engines and laundry, &c. (April 3rd.)

April 22nd. Installation of c.b. battery telephone switchboard and certain additions to the fire alarm system at the South-Eastern Fever Hospital, New Cross. (See this issue.)

April 27th. Installation of electric lighting, new main switchboard and power cables, &c., at the Grove Park Institution, Lee, S.E. (See this issue.)

Manchester.—April 15th. Two hand-operated overhead travelling cranes and one overhead runway; 20-ton road weighbridge. Mr. S. L. Pearce, manager, Electricity Department, Town Hall.

Middlesbrough. — April 15th. Electricity Department. Twelve months' supply of cables and a.c. meters. (April 3rd.)

Richmond (Surrey).—April 20th. Education Committee. Installation of electric lighting at the Darell Road Council school. (March 27th.)

Southampton. — April 28th. Electricity Department. 10,000-kW turbo-alternator, with condensing plant; 50-ton electrically-operated travelling crane; 2,000-kW rotary converter set, with transformer; starting panel, &c.; e.h.p. switch cubicles, control panels, indicating diagrams, &c.; d.c. switchgear; turbine boiler feed pump. (March 27th.)

Truro.—April 13th. City Council. Provision of an electric lighting scheme for the city area. (March 27th.)

Uruguay. — MONTEVIDEO. — May 12th. State Electricity works. H. and l.p. cables, telephone cables, junction and terminal boxes.*

April 15th. 45,700 to 56,000 metric tons of fuel oil.*

York. — April 24th. Electricity Department. Two 25,000-lb. water-tube boilers, economisers, fan chimneys, &c., one 1,500-kW rotary or motor converter, with switchgear, one 1,000-kW motor-generator and switchgear. (April 3rd.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—Electricity Commission of Victoria. Accepted:—

Supply of transformers of various capacities (£15,161).—Allmaenna Svenska Elektriska Aktiebolaget.—*Reuter's Trade Service* (Melbourne).

Ayr.—Town Council. Recommended:—

Electric lighting installation at 102 houses to be erected by the Town Council (£788).—Shaw & Gibson.

Bradford.—Electricity Committee. Recommended:—

E.h.p. armour-clad switchgear for 12 months.—A. Reyrolle & Co., Ltd.
Switchgear.—Metropolitan-Vickers Electrical Co., Ltd.
Cast-iron pipes for oil and air coolers.—E. & W. H. Halley, Ltd.

Bradford.—Electricity Committee. Accepted:—

Two tanks for turbo-generator at Valley Road Works.—Newton, Chambers and Co., Ltd.

Tramways Committee. Recommended:—

30 tons of Peckham band brake shoes (£307 10s.) and 80 tons cast-iron track brake blocks (£780).—Cole, Marchent & Morley, Ltd.

Markets Committee. Recommended:—

Repairs to economiser (£939).—E. Green & Sons, Ltd.
Superheater for Lancashire boiler (£175).—Superheater Units, Ltd.

Bolton.—Electricity Committee. Accepted:—
Air washer for the suction ash removal plant at Back-o'-th'-Bank.—Premier Cooler & Engineering Co., Ltd.

Bristol.—Great Western Railway Co.—Accepted:—
30-ton Goliath electric crane for the goods depôt at Bristol.—Clyde Crane and Engineering Co., Ltd.

Canterbury.—Town Council. Accepted:—
E.h.p. cubicles and switchboard for the new plant at the electricity works (£878).—Ferguson, Pailin, Ltd.

Eastbourne.—Electricity Committee. Accepted:—
14 transformers (£1,839).—British Electric Transformer Co., Ltd.
Screwing machine (£134).—A. C. Woodrow & Co.

Glasgow.—Housing Committee. Accepted:—
Electric lighting installation, Tollcross house purchase scheme (£1,983).—David Henderson.
Electrical installation, Govan Halls (£853).—W. Draper & Co. (recommended).

Tramways Committee. Recommended:—
Armature coils.—P. R. Jackson & Co., Ltd.
Car rheostats.—Rheostatic Co., Ltd.; Electro-Mechanical Brake Co., Ltd.
Phono electric trolley wire.—W. C. Yuille & Co., Ltd.
D.c.c. wire.—Siemens Bros. & Co., Ltd.

Hastings.—Electricity Committee. Recommended:—
21,000 yd. e.h.p. cable in connection with the proposed bulk supply to Bexhill Corporation (£25,594).—W. T. Glover & Co., Ltd.

India.—MADRAS.—Electric Supply Corporation, Ltd. Accepted:—
One 1,000-kW, two 500-kW, and one 250-kW rotary converters, with transformers and switchgear.—Electric Construction Co., Ltd.

Leeds.—Tramways Committee. Accepted:—
Tramway and railway crossing at Hunslet Carr (£725).—Titan Trackwork Co., Ltd.
Layout of railway siding at Kirkstall Road depôt (£210).—Thos. Summerson & Sons, Ltd.
Five miles trolley wire, 9½d. per lb.—British Insulated & Helsby Cables, Ltd.
Centrifugal oil purifier (£280).—De Laval Chadburn & Co., Ltd.

Electricity Committee. Accepted:—
Cables.—Enfield Cable Works, Ltd. (£1,809); W. T. Henley's Telegraph Works Co., Ltd. (£2,528); Hackbridge Cable Co., Ltd. (£364); Macintosh Cable Co., Ltd. (£1,578).

London.—METROPOLITAN ASYLUMS BOARD. Tuberculosis Committee. Recommended:—
Motor-generator booster set at St. Luke's Hospital (£105).—British Thomson-Houston Co., Ltd.

Works Committee. Recommended:—
Synchronised electric clock installation at High Wood Hospital for Children (£300).—Lund Bros. & Co.
Installation of electric lighting and power wiring in laundry and boiler house, South-Western Hospital.

S. Reed & Sons (Recommended)	**£403**
Unit Electrical Co.	470
British Electrical Installation Co.	492
Burdette & Co., Ltd.	518
T. Clarke & Co., Ltd.	529
Toy & Winslow	575
H. Seabrook & Co.	682
Belgravia Electrical Co.	709
G. A. Weston	720
Eastern Armature Winding Co.	725

Installation of three electric passenger lifts, Tooting Bec Hospital extension.

Holt & Willetts (Recommended)	**£1,485**
Titan Lift Co., Ltd.	1,530
Warburton & Co., Ltd.	1,672
Etchells, Congdon & Muir, Ltd.	1,740
W. Wadsworth & Sons, Ltd.	1,806
R. A. Evans, Ltd.	1,905
Waygood-Otis, Ltd.	1,909
John Bennie, Ltd.	2,195
H. Lowe & Sons, Ltd.	2,400

Extensions to the electric lighting installation at the North-Western ambulance station (£315).—Toy & Winslow (recommended).
Twelve tenders were received ranging from £315 to £478.
Four a.c. motors, starting panels, &c., at the S.W. Hospital (£171).—Power Contracts (recommended).
Renewal of electric storage battery, t.s. *Exmouth* (£226).—Tudor Accumulator Co., Ltd. (Recommended.)
Installation of electric lifts, Grove Park Institution (£1,050).—Holt and Willetts. (Recommended.)
Fourteen tenders were received varying from £1,050 to £1,920.
Overhauling electric lighting engines at Grove Park (£120).—Harland and Wolff, Ltd. (Recommended.)
The following tenders were received for installation of X-ray apparatus, Grove Park Institution:—

A. E. Dean & Co.	£297
Watson & Sons (Electro-Medical), Ltd.	305
Ditto, ditto (alternative)	361
Newton & Wright, Ltd.	367
Schall & Son	367
Medical Supply Association, Ltd.	397
X-Rays, Ltd.	401

LAMP CONTRACTS.—Contracts for the supply of Osram electric lamps have been placed with the General Electric Co., Ltd., by the Port of London Authority, the Metropolitan Water Board, and the Admiralty.

Manchester.—Education Committee. Accepted:—
Electric lighting installation, Higher Ormond Street school.—Lancaster and Bowen, Ltd.

Electricity Committee. Accepted:—
Cables.—British Insulated & Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.

Tramways Committee. Accepted. The following are included in the contracts for stores for 12 months:—
Armature coils, &c.—Manchester Armature Repair Co., Ltd.; P. R. Jackson & Co.
Insulating material, &c.—L. Andrew & Co.; Spicers, Ltd.; Hannett and Andrew; Connollys Bros. (Blackley), Ltd.; Griffiths Bros. & Co.
Controller fingers, &c.—Fairless Engineering Supplies Co., Ltd.; Forest City Electric Supply Co., Ltd.
Switches and sundry lighting material, &c.—General Electric Co., Ltd.; Metro-Vick Supplies, Ltd.
Electric bells, &c.—Till & Whitehead, Ltd.
Controller parts, &c.—British Thomson-Houston Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Cable.—Hackbridge Cable Co., Ltd.; Siemens Bros. & Co., Ltd.; F. Smith & Co., Ltd.

Oldham.—Baths Committee. Accepted:—
Electric motors for Waterhead Workhouse.—British Thomson-Houston Co., Ltd.

Plymouth.—Electricity Committee. Accepted:—
Cables.—British Insulated & Helsby Cables, Ltd.
A.c. and d.c. meters.—Ferranti, Ltd.
Transformers.—British Electric Transformer Co.; Metropolitan-Vickers Electrical Co., Ltd.
Sub-station switchgear.—A. Reyrolle & Co., Ltd.
Boiler feed pump.—G. & J. Weir, Ltd.

Salford.—Electricity Committee. Accepted:—
1,500-kW rotary converter and switchgear (£5,710).—Metropolitan-Vickers Electrical Co., Ltd.
It was reported that a Dutch firm's tender was £1,070 lower, but it could not complete the work in less than a year as against the British firm's five months.

Sheffield.—Electric Supply Committee. Accepted:—
Six 500-kVA and one 1,000-kVA transformers (£3,803).—British Electric Transformer Co., Ltd.

Sowerby Bridge.—U.D.C. Accepted:—
Housing scheme, electrician's work.—J. Quain.

Stirlingshire.—Denny Town Council. Recommended:—
Electric lighting extension at Duke Street, Denny.—E. Masson.

York.—Electricity Committee. Recommended:—
Feeder cables (£11,942).—Callender's Cable & Construction Co., Ltd.
Circulating-water pipes between Foss Islands station and the river (£823).—Wm. Birch & Sons, Ltd.

Forthcoming Events.

Institution of Electrical Engineers (East Midland Sub-Centre).—Tuesday, April 14th. At Loughborough College. At 6.45 p.m. Discussion on "Justifiable Small Power Plants," to be opened by Mr. A. B. Mallinson.

(Sheffield Sub-Centre).—Wednesday, April 15th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Paper on "The Strength of Metals at High Temperatures," by Dr. F. S. Goucher.

Junior Institution of Engineers.—Friday, April 17th. At 39, Victoria Street, S.W. Paper on "Vertical Retorts," by Mr. W. T. Dunn.

British Electrical Development Association.—Friday, April 17th. At the Hotel Cecil. At 12 noon. Annual meeting. At 1 p.m. Annual luncheon.

Notes.

Voltage Regulation by Static Transformers.—CORRECTION.—Referring to the calculation at the foot of page 525, the author desires to substitute a line carrying 18,000 kVA, and for $1/\sqrt{3}$ to read 1/3. Then one-third of the boosted power is $18{,}000/10\times3=600$ kVA, and if the current in the local boosting circuit is fixed at 200 A, the corresponding maximum voltage is $600\times1{,}000/200=3{,}000$ V.

Public Lighting Conference.—A conference of the Institution of Public Lighting Engineers will be held at Leeds on September 14th, 15th, and 16th. The members and delegates will be received by the Rt. Hon. the Lord Mayor, and entertained by the Chairman and the Lighting Committee of Leeds. In addition to the address by the incoming President, Mr. C. S. Shapley, of the City of Leeds Corporation, several papers will be read dealing with important problems of public lighting. Inspection will be made of local systems, and an exhibition of some of the most modern street lighting appliances will be held. An appeal is being made to all municipal authorities for representation at the conference and in the Institution. Full particulars can be obtained from Capt. W. J. Liberty, secretary, The Institution of Public Lighting Engineers, c/o Public Lighting Office, Guildhall, London, E.C.2.

Australian League Visit to Lamp Works.—The 122 boys and 10 officers of the Australian League Contingent which is concluding its European tour in this country, were the guests of the General Electric Company, Ltd., on March 31st, at the Osram Lamp Works. The visit proved a great success, and the event will no doubt be recalled by the boys as one of the outstanding features of their great tour. The party was conducted in small groups round the extensive works, each group being under the guidance of a member of the G.E.C staff. The visit was concluded with tea at the works.

Canadian Hydro-Electric Development.—The latest report issued by the Dominion Water Power and Reclamation Service of the Canadian Department of the Interior brings the figures of hydro-electric development in Canada up to June 1st, 1924. At that date the total water power in actual use was 3,569,275 h.p., and of this 2,696,907 h.p. was being developed by central stations, 503,039 h.p. by pulp and paper mills, and 369,239 h.p. by other industries. The bulk of the total is represented by development in Ontario and Quebec, whose respective totals are 1,585,182 h.p. and 1,306,106 h.p. The total installed generator capacity in the Dominion was 2,046,104 kVA at June 1st, 1924.

The latest figures of the water power available show 18,255,316 h.p. at ordinary minimum flow, or 32,075,998 h.p. at ordinary six-months' flow.

Cathode-Ray Oscillograph.—The Liverpool University has acquired a cathode-ray oscillograph, one of about four in use in this country. At a recent meeting of the Liverpool Wireless Society, Prof. E. W. Marchant, D.Sc., M.I.E.E., spoke of the difficulties of the measurement of the strength of wireless signals. With the instruments the Liverpool University now had it was possible to measure such small amounts of power as a ten-billionth of a horse-power.

L.C.C. Auditor and Tramway Burdens.—In the course of his report upon the accounts of the London County Council for the year 1923-24, the District Auditor says with regard to the tramways:—"In addition to the statutory obligation which is cast upon all local authority trading enterprise in respect of debt redemption, the tramway undertaking is called upon to bear other financial burdens of considerable magnitude, *viz.*: (1) Rates upon the permanent way; (2) charges, mostly of a capital nature, in connection with street improvements; and (3) maintenance of the surface of the road between and beyond the tramway track. During the year 1923-24 the charges for rates upon the permanent way amounted to the sum of £61,413. The total capital sum expended on the execution of street improvements and charged to the tramways amounts to £809,295, which involved debt charges during the year under review of £30,545. In connection with road maintenance the burden is much heavier, and approximately £242,250 was spent during 1923-24 out of revenue on repairs and renewals of paving, and about £3,300 in respect of interest on capital sums paid by way of compositions for road maintenance to certain borough councils when acquiring tramways, and whereby in these special cases the Council has been relieved of further expenditure on the upkeep of these roads. Expenditure under this heading is estimated to have saved during the last seven years a sum approaching £1,750,000 to those local authorities who would otherwise have been responsible for the road maintenance. It seems clear that the original reason for requiring tramway undertakings to bear the liability for maintaining the more costly part of the roads along which they run was connected with the special strain which horse-drawn cars cast upon parts of the road surface. At present, however, tramcars appear to tear up no part of the surface other than the track which is provided at the cost of the undertaking. It is not for me to comment upon the unreasonableness or otherwise of the above liabilities which form so large a proportion of the tramway's expenditure and are highly controversial questions, but unless some relief can be obtained it is difficult to see how the undertaking can be operated on a fair and economic basis. Under present conditions, added to the increased wage bill commitment, reduction of annual working costs in other directions and an increase in revenue must be obtained if charges upon the special county rate are to be avoided."

British Non-Ferrous Metals Research Association.—We have received a copy of the fifth annual report of this Association for the year ending December 31st, 1924. Probably the great event of the year for the Association was the offer of a further Government grant. This amounts to a total of £24,000 in the next five years, contingent on the Association raising in subscriptions from the industry a total contribution in this period or £56,000. The Government grant would start with a maximum of £8,000 for the first year, and diminish each year by 20 per cent. of this amount, conditional on the individual subscriptions attaining £8,000 in the first year and increasing year by year by 20 per cent. so as to make good the deficiency and assure an annual income of £16,000.

The provision of a small central laboratory at the Birmingham University has been arranged in the Association's interest. In notes on the practical results already obtained from the researches of the Association, it is said that it has been demonstrated that if kept below a definite limit in connection with soft solders, antimony is not harmful, but actually beneficial. The application of this discovery, which enables the expensive metal tin to be replaced by antimony and lead, should yield a saving in the intrinsic cost of the raw materials of a clear 5 per cent. A progress chart shows the experimental expenditure to rise from under £700 in 1920 to nearly £16,000 in 1924.

On Friday last, after the fifth annual general meeting of the Association, the members partook of luncheon at the Savoy Hotel, the chairman, Mr. Thos. Bolton, presiding. After the loyal toast, Mr. Bolton addressed the audience, remarking that a sense of fellowship was essential to industrial success; he hoped the appeal of the Prime Minister would not fall on barren soil—otherwise the prospects would be gloomy. The Association stood for fellowship, and for co-operation between the manufacturers themselves, and between them and the suppliers of raw material, the suppliers of plant, and the users of their products, and above all, between the industrialist and the scientist. They had had a very successful year, and £16,000 was to be spent on research this year, of which half would be provided by the Government. The Department had shown them the greatest consideration, and the grants made to date amounted to £20,000; but they must become self-supporting. The Advisory Committee which had investigated their work had reported entirely in their favour, and further grants amounting to £24,000 would be made, diminishing to zero in five years, during which period they must increase their own contributions to maintain the standard revenue. The work was of direct interest to every member; they had already expended £40,000, and new members would have the benefit of that outlay, whilst users of their products were particularly desirable as members. Important researches were in progress, and he specially acknowledged help afforded by the Metropolitan-Vickers Co.

Sir Robert S. Horne, G.B.E., declared that the necessity of the union of industry and science was beyond question; only by that means could this country keep in the van of progress. The situation now was most difficult; the only hope lay in cheaper production.

Eng. Vice-Adm. Sir Robert B. Dixon, K.C.B., said the work of the Association was of particular value to the Navy; just now an alloy that would stand a light load at a temperature of 800-850 deg. C. was specially wanted. Of the 163,000 condenser tubes of the special squadron which had travelled 40,000 miles and had been under steam for ten months, only five gave out.

Mr. Douglas Vickers said he had had experience with the old trial and error methods in the case of steel manufacture, and with the research methods which superseded them; the former were wasteful. The Research Association applied proper methods, employing men of insight and imagination, and deserved support.

Mr. H. T. Tizard, of the Department of Scientific and Industrial Research, said that the Association was entering upon the second and most critical period of its existence; it would only be strong and healthy when free from Government control, but he looked forward to its continued close co-operation with the Department after it had gained its freedom. He spoke in high praise of the work of the Director of Research, who had suggested various additional investigations, to which financial support had been given.

Radio on the "Turf."—At Longchamps, on April 5th, experiments in the use of wireless telephony were made with a view to the speeding up of paying-out operations by the pari-mutuel, and the communication of results and returns to the Press. Four short-range stations were installed, two in the central offices of the pari-mutuel, where all calculations are done. One was in touch with a third station in the weighing-in room, and the other in touch with a fourth station in the Press room.—*Evening News.*

Educational.—East London College.—A conversazione was held at East London College, University of London, on March 31st, when the Chairman of the College Council, Mr. E. de Q. Quincey, and the Principal of the College, Mr. J. L. S. Hatton, received the Master and Wardens of the Drapers' Company in the Queen's Hall of the People's Palace. Afterwards the students and their guests inspected the laboratories, in which numerous experiments were conducted. Interesting demonstrations of "Phonofilms" were given by Mr. C. F. Elwell, and of the "Magnification of Sound" by Prof. J. T. MacGregor-Morris, who illustrated his short lecture by broadcasting to the audience the sound of a pin dropping, his watch ticking, &c. The Astronomer Royal, Sir Frank Dyson, delivered a short lecture on "Eclipses," and Prof. J. R. Partington gave one on "Flames and Explosions." During the evening the Royal Artillery String Band, charmingly assisted by the vocalist, Miss Dora Labbette, delighted an audience in the Queen's Hall.

Southampton Exhibitions.—The Council of the University College of Southampton has decided to award two open entrance exhibitions in Engineering to candidates who have matriculated and are prepared to read for a degree in engineering.

An X-Ray Safeguard.—According to the *Matin*, two French scientists have invented a filter, made of a plastic substance that is only transparent in the case of yellow and red rays, which, it is claimed, will render X-rays harmless, thus making it possible to obviate injury to X-ray operators.

International Electrotechnical Commission.—The International Advisory Committees of the I.E.C., a number of which held meetings in London last year during the World Power Conference, are to meet at the Hague, commencing on April 16th, when the following subjects will be considered:—Traction motors, terminal markings, symbols, nomenclature, rating, rules and regulations, standard pressures, transformer oils, prime movers, and lamp caps. Experts have been invited to write papers on the different subjects at present being studied in order to elucidate the various underlying problems, those received from Great Britain being on:—"The basic principles which should govern a test specification for traction motors in order to correspond with actual working conditions," by Col. E. O'Brien and Mr. F. W. Carter, of the British Thomson-Houston Co., and "Transformer oils: sludge as a chemical and physical phenomenon," which is being prepared by the Electrical Research Association. The 12 papers will be read during the first two days of the conference. One of the most important subjects to be discussed is a specification for oil for transformers and an attempt is to be made to obtain international agreement. The countries sending delegates to this particular Advisory Committee are Belgium, France, Great Britain, Holland, Italy, Switzerland, and the U.S.A. German delegates have not yet been invited to join these advisory meetings, which may still cause some delay, as obviously it is difficult to make progress internationally in electrical technical matters without the full co-operation of the German electrical industry. It is anticipated that some 60 delegates will be present from 23 countries.

Second Illumination Design Course.—It was recently reported that a large number of engineers representing supply authorities in all parts of the country attended the illumination design course arranged by the Electric Lamp Manufacturers' Association for four whole days in order to be made *au fait* with the most recent advancements in the science of illumination. Since then a number of letters of appreciation have been received stating how useful the information which was given has already proved, and that every day the knowledge gained is being put into practice. The whole of the electrical industry is intimately concerned with lighting, for wrong methods of its application are so blatant that they reflect upon the industry as a whole, and it is in order to rectify this position that the courses are being given. Further design courses are to be given from April 21st to 24th for electrical wholesalers and factors, and from May 12th to 15th for electrical contractors. Those who are desirous of attending either are asked to write immediately to the E.L.M.A., Lighting Service Bureau, 15, Savoy Street, W.C.2, in order that a place may be reserved for them.

Radio Reception in the Sahara Desert.—The interesting photograph reproduced below was taken in the Sahara desert about 250 miles south of Algiers, and shows the party listening to Radio-Paris on a set of "Radio Brix" assembled in the following order: Nos. 9, 8, 12, 9, and 6, to form Metro-Vick circuit No. 57, with the addition of a small "Dragon-fly" loud-speaker. The circuit is of a special "all-wave" form embodying a detector valve and one dual valve; the h.f. stage is tuned anode, but of a special form coupled through a condenser to the anode of the valve, the h.p. of which is supplied through a h.f. choke coil having an inductance of about 80,000 micro-

Radio Reception in the Sahara Desert.

henries so that practically all the radio-frequency impulses, even at long wave-lengths, pass through the adjacent tuned circuit and this, in turn, passes them on to the grid of the detector valve. The aerial used was a single wire strung to a 40-ft. date palm in the oasis, with counterpoise earth consisting of a single wire stretched along the sand directly beneath the aerial. The letter accompanying the photograph explains that along the south coast of the Mediterranean Sea the station at Chelmsford, Radio-Paris, and several other European stations are regularly heard at full loud-speaker volume.

Wireless for Ships' Lifeboats.—Orders for lifeboat wireless sets of the latest pattern, numbering nearly ninety installations, have recently been received by the Marconi International Marine Communication Co., Ltd. In the latest Marconi set a valve receiver has been introduced with a ¼-kW quenched-spark transmitter, which is operated by power supplied by a specially designed petrol engine, or alternatively from a battery of accumulators, and has a range of from 50 to 60 miles when working to a crystal receiver. The receiver uses dull emitter valves, and has a range of reception of not less than 80 miles, depending on the power of the transmitter from which it is receiving. A directional aerial used in conjunction with the boat's main aerial enables the bearing of neighbouring ships to be determined. The set is designed for use as an all-round receiver as well as a direction finder. Fresh orders have been received for seventeen sets to be supplied to Messrs. John I. Thornycroft & Co., Ltd., for lifeboats for the Peninsula and Oriental Steam Navigation Co. The P. & O. Co. has also ordered two complete sets with searchlights to be installed on the *Naldera* and *Narkunda* this month, when those ships return to this country.

In addition, ten further sets are being supplied to Messrs. Wm. Hill, Ltd., of Tyne Dock, for the P. & O. line. This will make a total of 33 vessels of the P. & O. line carrying lifeboats fitted with Marconi wireless apparatus, all except one of which will also have direction finding equipment.

Messrs. Harland & Wolff, Ltd., have also given a further order for twenty-two installations, which will be fitted in various lifeboats at Belfast, Liverpool, and Southampton, within the next few weeks.

The Canadian Pacific Steamships, Ltd., has ordered twenty-seven lifeboat sets, complete with directional receiver and fittings; searchlight equipment is also being installed for this company.

Two sets have been ordered by the Atlantic Transport Co. for motor lifeboats which it is installing on two of its ships.

Four sets are being installed for Messrs. Anchor-Donaldson, Ltd., in lifeboats under construction for the steamers *Athenia*, *Letitia*, *Cassandra*, and *Saturnia*.

Four sets with searchlights are to be installed in lifeboats under construction by Messrs. N. Hamblin & Co., Ltd., of Blackwall, who contemplate installing further sets of the same type.

Phase Converters on Locomotives.—According to the *Electric Railway Journal*, two 4,200-h.p. electric locomotives which are being supplied to the Loetschberg Railway, are to be equipped with phase converters in order to convert the single-phase energy from the line into polyphase. The locomotives, which are being supplied by the Société Anonyme des Ateliers de Sécheron, Geneva, Switzerland, are to be used for freight and passenger traffic, and will be employed more particularly on the heavy grade division of the railway, between Frutigen and Kandersteg.

The locomotives will be equipped with six twin motors, each capable of developing 700 h.p. for the hour. Oil immersed transformers are to be used for reducing the line pressure and for supplying a variable voltage to the driving motors, which will be controlled by means of electro-pneumatic contactors, the arrangement being the same as that adopted on the single-phase locomotives built at the Sécheron works for the Swiss Federal Railways.

The Institute of Metals Election. — An election of new members and students of the Institute of Metals, particulars of which can be obtained from the Secretary, Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W.1, will take place on April 27th. In connection with the 15th annual May lecture which is to be given by Professor H. A. Lorentz, of Leiden, Holland, on May 6th, tickets for this can also be obtained from Mr. Shaw Scott. The subject of the lecture is "The Motion of Electricity in Metals." The subscriptions of persons elected will cover the usual period of twelve months and also the extended period ending June 30th, 1926.

Institution Notes.

Institution of Electrical Engineers.—North-Western Centre.—The annual meetng of the North-Western Centre was held on Tuesday, March 31st, at the Engineers' Club, Manchester, the chairman of the Centre, Mr. H. C. Lamb, presiding. The report of the Committee stated that 11 meetings had been held during the session, the average attendance being 195. There had been an increase in all classes of membership, except Associates of whom there were now 10 against 13 last year. The Members had increased to 114, Associate Members to 403, Graduates to 100, and Students to 442, the total being 1,069, against 1,023 last year. Regret was expressed by the Committee that Mr. A. B. Mallinson had found it necessary to resign the honorary secretaryship, which he had held for three years, and a vote of thanks to him for his services was unanimously passed. A vote of thanks was also accorded to the chairman, Mr. Lamb. The officers for the next year will be:—Chairman: A. G. Ellis; vice-chairmen: W. J. Medlyn and H. A. Ratcliff; hon. secretary: A. L. Lunn; assistant secretary: A. L. Green. Four new members of the Committee were elected—J. Frith, T. E. Herbert, A. B. Mallinson, and G. G. L. Preece. Mr. C. J. Beaver read a paper on "The Manufacture and Installation of High-voltage Cables."

North-Eastern Centre.—During the discussion of the paper by Colonel T. F. Purves on automatic telephone systems, at a meeting of this Centre in Newcastle-on-Tyne, on March 23rd, Mr. Elliott, a member of the Institution of Post Office Engineers, said that in Newcastle it was proposed to have three automatic exchanges, one in the centre of the town, one in the east, and the third in the west end. As a matter of fact, sites had been acquired for all three, but, unfortunately, the site required for the central exchange was now wanted for a new road from the new bridge. He was very much afraid that the difficulty they would encounter in acquiring a new and suitable site would very seriously delay the project as a whole. The unfortunate part about it was that it took such a long time to bring an automatic exchange into use.

The Incorporated Municipal Electrical Association.—Preliminary Programme.—The thirtieth annual convention is to be held at Brighton, from June 15th to 20th, 1925, commencing on Monday evening, June 15th, with a reception by the president and Mrs. W. C. P. Tapper, the Mayor and Mayoress of Stepney (Mr. and Mrs. J. D. Somper), the chairman of the Stepney Electricity Committee (Mr. J. W. Rosenthal and Mrs. Rosenthal), in the Royal Pavilion, with dancing to follow. On Tuesday the Convention will be opened with a civic welcome by the Mayor of Brighton (Ald. C. J. Teasdale, J.P.), and an address by Mr. W. C. P. Tapper, president of the Association and engineer and manager of the Metropolitan Borough of Stepney Electricity Supply Department. There will also be a paper on "Street Lighting," by Mr. Hadyn Harrison, M.I.E.E. In the evening there will be a reception by his Worship the Mayor and Mayoress of Brighton.

The next day will be devoted to a paper on "Installation Policy: Its Importance to the Electricity Supply Industry," by Mr. L. L. Robinson, borough electrical engineer, Hackney

Electricity Department, and its discussion; a visit by charabanc to Worthing power station, returning *via* Arundel; and a "Special I.M.E.A. Evening."

Thursday morning will be occupied by a paper and discussion, and the afternoon by a visit to Brighton Corporation power station, Southwick, and remote-controlled sub-station, Kemp Town. In the evening the annual dinner will take place.

On Friday the annual general meeting will be held, followed by a visit by charabanc to Eastbourne power station, returning *via* Peacehaven and Seaford; and for Saturday visits will be arranged to the Brighton Corporation Tramway Department car sheds and workshops, the works of Messrs. Allen West & Co., Ltd., and Messrs. Volk's Electrical Railway on the sea front.

An exhibition of electric cooking and water-heating apparatus, &c., will be held, and will include a demonstration of modern lighting methods. All communications prior to June 12th should be sent to the Secretary, I.M.E.A., Electricity Works, Croydon.

Junior Institution of Engineers.—On March 27th, Mr. A. P. Morris lectured on the subject of "Irrigation Engineering in Burma." Incidentally, he mentioned that machinery sent out from home to out-of-the-way parts of the Empire was often not given a chance to show its usefulness, because the selling agent knew nothing about the erection and operation of the plant. He referred specifically to an electric lighting plant, and suggested that a selling agent should have engineering as well as commercial experience.

On April 3rd, Mr. Geoffrey W. Tookey delivered a lecturette on the subject of "Engineering Contracts." He said that a tender was often accompanied by printed "Conditions of Sale," obviously drawn up in the first place by a central trade organisation, which operated very decidedly in favour of the manufacturer; it was probable that the purchaser who assented to the conditions never read them or understood them, and the fact that manufacturers were willing if pressed to accept terms more favourable to the purchaser, without increase in price, seemed to indicate that they played rather too much on the chance that the conditions were not read and appreciated.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Mr. A. L. Wild, charge engineer at the generating station of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, has been presented with a clock on the occasion of his leaving to take up an appointment with the Yorkshire Electric Power Co.

Mr. A. M. Cowie, D.S.M., has been appointed wireless telegraphic supervisor to the Port Directorate of Basra, Iraq. He became a wireless operator while in the Royal Navy, and distinguished himself in the war.

The Maidstone Town Council has increased the salary of Mr. A. T. Lambert, light railway manager, from £600 to £650 per annum.

On March 27th the London membership of the Electrical Trades Union presented Mr. W. J. Webb, the London district secretary, with a silver tea service and tray on the occasion of his marriage. Mr. H. H. Morton, secretary of No. 1 Station Engineers, made the presentation at a gathering of over 250 members, at the London and Brighton Hotel, Peckham.

Mr. B. England, manager at the Castleford depôt of the Yorkshire (West Riding) Tramways Co., who is leaving to take up a higher position at Wakefield, has been presented by the staff with a mahogany clock.

Mr. W. E. Hardy, engineer and manager of the Bath Tramways Co., Ltd., has been appointed managing director of the company.

Mr. F. H. B. Bellamy has resigned from the British Electric Transformer Co., Ltd., and has been appointed sales engineer with the Hotpoint Electric Appliance Co., Ltd.

Sir George Sutton, Bart., M.I.E.E., the chairman and managing director of W. T. Henley's Telegraph Works Co., Ltd., is president-elect of the British Electrical Development Association for 1925-1926, and he will preside at the annual luncheon to be held, as already announced, next Friday, April 17th.

On April 1st, at the Trocadero Restaurant, London, Mr. Edgar S. Barralet presided over a gathering of fifty representative electrical men who were present to do honour to Mr. J. Snow Huddleston, marking his election to the chairmanship of the Cable Makers' Association. Mr. Barralet, in submitting the toast of the evening, referred in cordial terms to Mr. Huddleston's popularity throughout the industry and to his steady rise to his present position by perseverance on the one hand and geniality of temperament on the other. His many services to the electrical industry needed no advertising and especially those rendered to the cable section, with the success of which he had had a great deal to do. The honour of the chairmanship of the C.M.A. was well-merited. Mr. Barralet concluded by amusing references to Mr. Huddleston's proclivities as a poultry farmer, particularly in the rearing of Red Rhode Islands and White Wyandottes. After the toast had been musically honoured a present of a beautiful basket of flowers for Mrs. Huddleston was made and immedistely dispatched by car. Mr. Huddleston, in reply, feelingly acknowledged the present to his wife and thanked the company for the cordial manner in which the toast of his health had been received and for the honour paid him that evening. In a most interesting speech he recalled the early days before the C.M.A. was formed when there was very little money in the industry and such things as standard cable sizes were considered taboo. With the assistance of his colleagues in the cable industries the work of the C.M.A. had been brought to fruition, with immense benefit to the electrical industry generally. There had resulted not only a standardising of sizes but a stabilising of prices and the setting up of a standard of quality which made British cables the best in the world. He felt proud to be the titular head of the C.M.A. and was especially pleased to see around him that evening the cheery faces of men he had known for so long. He concluded by quoting Paul Richter's famous couplet "Long live friendship, may the spot be green where it commenced, may every place bloom where it grew and when all its bloom is over and its leaves withered and fallen away, may friendship still continue." An excellent concert followed, and before the singing of "Auld Lang Syne" Mr. E. E. Hoadley proposed the toast of Mr. R. W. Smith, the organiser of the gathering, and Mr. Smith suitably responded.

At the Royal Pavilion, Brighton, the staff and employés of the Corporation Electricity Department held a social gathering last Friday, between 600 and 700 being present. The company included the whole of the employés not on duty, accompanied by their lady friends. The Mayor and Mayoress, the Chairman of the Electricity Committee, and the heads of various municipal departments were also present. During the evening, in the Dome, Mr. John Christie, the engineer and manager, was presented with an armchair, and Mrs. Christie with an attaché case, to mark the completion by Mr. Christie of 25 years' service with the Department. Mr. G. Claughton, the chairman of the Social Committee, made the presentation in the name of the entire staff. He referred to Mr. Christie's gift of encouraging the staff to greater efforts at times of special crisis. He said it was much harder to get a smooth-running human element than a smooth-running mechanical element, but Mr. Christie accomplished both with his equable temperament, his optimistic outlook on life, and his very human treatment of the staff. Mr. Christie, in responding, referred to his happy surroundings, the healthy town, his pleasant work, his considerate committee, his luck in choosing a good wife, and his happy staff, all of which had made his life a happy one during the 25 years. He quoted figures regarding the growth of the undertaking, and prophesied a great future for it in the supply of electricity for domestic heating and cooking, the "golden age of electricity" having come. The programme included dancing in the Banqueting Room and the Rotunda, also a whist drive, concert, games, a fancy dress parade and other interesting items, all of which contributed to a most successful evening.

Mr. T. H. Dennis, M.I.E.E., managing engineer, Straits Trading Co., Ltd., Singapore, expects to be in England on leave from April till October this year. His address will be c/o Adamson, Gilfillan & Co., Ltd., 2, Billiter Avenue, London, E.C.3. Mr. Dennis received his training with Messrs. Crompton & Co., Ltd., at Chelmsford. Since 1906 he has been in Singapore.

Dover Town Council has increased the salary of Mr. C. S. Grieff, power station superintendent, from £420 to £450 per annum.

Mr. F. J. Frost, for 12 years' traffic superintendent of the Kent Telephone District, who is leaving to take charge of the newly-combined Plymouth and Exeter districts, has been presented by the staff at Canterbury with a gold wristlet watch, and by the supervisor and officials at the Folkestone Exchange with a silver cigarette case.

St. Helens Town Council has increased the salary of the electrical engineer, Mr. Baker, from £660 to £725 per annum. The Staffs Sub-Committee recommended that the increase should be to £800.

Mr. R. G. Cunliffe, M.Sc. (Tech.), Assoc.M.S.T., A.M.I.C.E., A.M.I.E.E., for some years one of the chief representatives for Metropolitan-Vickers Electrical Co., has been appointed general manager and chief engineer to the Calcutta Tramways Company. He is leaving for India in May.

At the quarterly meeting of the North Wales and South Cheshire Joint Electricity Authority, Lieut.-Col. F. A. Cortez Leigh, the vice-chairman, was congratulated on his recent appointment as electrical engineer of the London, Midland and Scottish Railway.

Press reports state that Mlle. Irene Curie, aged 20 years, one of the two daughters of Mme. Curie, read a paper on the "Alpha Rays of Polonium," as a thesis for the degree of Doctor of Science of the University of Paris last week.

The Northampton Town Council is recommended to increase the salary of the tramway manager, Mr. J. F. Cameron, from £684 with bonus, to £700 per annum.

With reference to the brief mention of the matter in our last issue we now learn that Mr. P. J. Pringle, general manager and chief engineer of the Electric Supply Company of Victoria, Ltd., Australia, and his wife, left Melbourne by the *Mooltan* on February 17th, and they expect to arrive in London on May 4th. They are spending six and a half weeks on the Continent before arriving. Mr. Pringle's address will

be the Company's Head Office, 255, Royal Liver Buildings, Liverpool. Mr. Pringle was entertained to a complimentary farewell or "smoke night social" by the staff and employés on February 12th, Mr. W. Knox presiding. The speeches showed the high appreciation in which Mr. Pringle is held. He was presented with a gold cigarette case, together with a travelling clock for Mrs. Pringle.

Mr. P. E. Bourne, late of Faraday House, has been appointed sub-station attendant by the Torquay Electricity Department.

Obituary.—Mr. T. J. Reynolds.—With reference to the brief notice which appeared in our last issue, we learn that Mr. T. J. Reynolds, whose death occurred on March 23rd, was for many years in charge of the installation of all turbo-generator plant manufactured by the British Thomson-Houston Co., Ltd. He had been in bad health for some time. He leaves a widow and four children, and his death will be greatly regretted not only by the company, to whom he had been a faithful servant for so long, but also by very many central station and other engineers throughout the country amongst whom he was widely known and very highly respected. For the past 22 years Mr. Reynolds had been closely identified with B.T.-H. turbines, and was possessed of special experience and skill in their installation and maintenance. The second son of the late Major T. W. Reynolds, R.A.S.C., he was born at Aldershot on December, 1876. He was trained in the steam and mechanical engineering departments of Messrs. Combe, Barbour & Combe, Ltd., Belfast, and after many years in the Merchant Service—P. & O.S.N. Co., and Ocean Steamship Co., Liverpool (Alfred Holt & Co.), he joined the B.T.-H. Co.'s construction staff, being placed in charge of his department in 1913. His elder brother, Eng.-Lieut.-Commdr. W. H. Reynolds, R.D., R.N.R. (ret.) is the South Wales district manager for Messrs. Babcock & Wilcox, Ltd., and the present chairman of the South Wales Branch of the Institution of Mechanical Engineers. The funeral took place at Arnside on March 27th, and was attended by a number of important officials of the company and members of the construction staff from various districts throughout the country.

Sir W. Acworth.—We regret to record the death, which occurred on April 2nd, in London, at the age of 75, of Sir William Acworth, the well-known authority on railways, railway organisation, and transportation. He had in the course of his career sat on various Railway Commissions here and in other lands, and was consulted as an expert by the railway authorities in different parts of the British Empire and in foreign countries. He was author of a number of books, and a frequent contributor to the Press and to societies on the subject which he had made his own. He was a director of the Underground Electric Railways Co. of London, Ltd., the London & Suburban Traction Co., the Metropolitan Electric Tramways, Ltd., and other companies, and was chairman of the London United Tramways, Ltd.

Mr. A. T. Kinsey.—The death occurred suddenly of heart failure, on March 19th, at his residence at Samarés, Jersey, of Mr. Albert Thornley Kinsey, A.M.I.E.E. Mr. Kinsey, who was 62 years of age, was engineer-in-charge of the Jersey State Telephones. Formerly he was assistant superintending engineer in the G.P.O., South-Western District (Bristol).

Mr. A. Jacob.—We learn with deep regret of the death, which occurred on April 3rd, at Hatch End, Middlesex, at the age of 57 years, of Mr. Arthur Jacob, M.I.E.E. Mr. Jacob had been in poor health for two years, but he seemed to be recovering until a few months ago, when he began to fail and the end came somewhat unexpectedly. He was a manager of the British Aluminium Co., Ltd. (which company he joined in 1908) responsible for the development of the use of aluminium for industrial purposes in general and electrical purposes in particular. He was charged also with the direction of certain of the company's subsidiary undertakings. Mr. Jacob was associated with Dr. S. Z. de Ferranti at the Grosvenor Gallery and Deptford from 1884 onwards. Subsequently, he was for many years engaged in the construction and management of electrical engineering undertakings, and had a personal connection with the leading engineers and directors of engineering concerns throughout the country. The principal work upon which he had been engaged during the past thirty years was as follows:—He was resident engineer to the British Thomson-Houston Co. for the complete electrification of the Dublin United Tramways Company's system, which included the erection of two power stations, sub-stations, and the electrical equipment of over 42 miles of track and 300 cars. Later he undertook the general management of the British Schuckert Electric Co., Ltd., London, which was subsequently taken over by Siemens-Schuckertwerke, Berlin. Afterwards he was responsible for the management of the Central Station Department of Messrs. Siemens Brothers Dynamo Works, Ltd., of London and Stafford. This engaged his attention for three years preceding his acceptance of the British Aluminium appointment in 1908. Mr. Jacob was a member of the Overhead Wires Committee of the British Engineering Standards Association; also a member of the Overhead Wires Committee of the British Electrical Research Association. In addition to being a member of the Institution of Electrical Engineers, he was a member of the American Institute of Electrical Engineers, the American Electrochemical Society, the Institute of Metals, and he was also identified with the work of the British Engineers' Association, the Federation of British Industries, the Industrial League and Council, and other organisations.

Will.—The late Mr. H. W. Sullivan left £91,833.

New Companies Registered.

Burndept Wireless, Ltd. (204,828).—Registered as a "public" company on March 27th (delayed at Somerset House) with a nominal capital of £430,000 in 400,000 preferred ordinary shares of £1 each and 600,000 deferred ordinary shares of 1s. each. The preferred ordinary shares rank first for a cumulative preferential dividend of 7½ per cent. per annum; after which 20 per cent. of the remaining profits in each year available for distribution is to be allocated to reserve until such reserve amounts to £100,000. The directors have also general power to carry any sums to reserve and to carry over any profits which they may not think it prudent to divide. Subject as above, one moiety of the surplus profits goes to the preferred ordinary and the other moiety to the deferred ordinary shareholders. In a winding up, the preferred ordinary rank first and the deferred ordinary next for repayment of capital, and each class takes one moiety of any surplus assets. Voting papers: one vote for each preferred ordinary share and one vote for every three deferred ordinary shares.

The objects are:—To acquire all or part of the business of wireless instrument manufacturers heretofore carried on by Burndept, Ltd., at Blackheath, S.E., and elsewhere, and all or some of the assets of the said company (including particularly the trade mark "Burndept"), and to enter into an agreement with the Radio Co. of Great Britain, Ltd. The subscribers (each with one £1 share) are:—F. J. Groombridge, 2, Cambrian Road, Leyton, solicitor's clerk; W. Westaway, 23, Bessborough Gardens, S.W.1, solicitor's clerk; and five other clerks. The minimum cash subscription is seven shares. The first directors, to number not less than two or more than ten, are to be appointed by the subscribers.

A letter signed by the subscribers on March 21st stated "no persons have yet been proposed or appointed as directors or consented to act in that capacity," but the names were given in the prospectus issued on Monday last. They are:—Lord Lurgan, K.C.V.O. (chairman); G. E. Duveen; W. Witt Burnham; Sir C. G. C. Hamilton, J.P.; J. E. Monins, J.P.; and C. F. Phillips, M.I.E.E.

Qualification, £500. Remuneration, £300 each per annum (£350 for the chairman), free of income tax.

The amount owing in respect of moneys borrowed by the directors is not at any time to exceed the amount of the issued capital without the consent of a general meeting, and the directors may not issue debentures or debenture stock, or any other specific or floating security (except to secure loans from bankers or others in the ordinary course of business) without the consent of an extraordinary resolution of the preferred ordinary shareholders at a separate meeting. Solicitors: Herbert Smith, Goss, King & Gregory, 62, London Wall, E.C.2.

Power Contracts, Ltd. (204,872).—Private company. Registered March 28th. Capital, £10,000 in £1 shares. Objects: To acquire the business of electrical engineers carried on by E. H. Bates and T. H. Windibank at 140, Southwark Street, S.E., as "Bates & Windibank," and to carry on the same and the business of suppliers of electric energy and other forms of power. The directors are:—E. H. Bates, 16, Onslow Avenue Mansions, Richmond, electrical engineer; T. H. Windibank, Court Lodge, Tunstall Road, East Croydon, electrical engineer; H. Foster, 35, Hamilton Road, Ealing, W.5, electrical engineer; A. Parkinson, address not stated; F. Parkinson, 47, Victoria Street, Westminster, S.W.1. Qualification, £100.

F. Miller & Co. (London), Ltd. (204,974).—Private company. Registered April 1st. Capital, £1,000 in £1 shares. Objects: To acquire the business of an engineer and merchant now carried on by F. Miller at Trafalgar Buildings, 1, Charing Cross, S.W., as "F. Miller and Co.," and to carry on the business of electrical, mechanical, motor, telephone, constructional and general engineers, manufacturers, inventors, designers and repairers of and dealers in electrical goods, accessories and materials of all kinds, internal combustion engines and fittings, &c. The subscribers (each with one share) are:—F. Miller, 57, Church Fields, South Woodford, Essex, engineer; Lily E. Worsdell, 36, Gambole Road, Tooting, S.W.17, secretary. F. Miller is permanent director.

The Mexican Hydro-Electric Development Syndicate, Ltd. (204,903).—Registered as a private company on March 30th, with a nominal capital of £26,000 in £1 shares. The objects are:—To carry on the business of an electric light, heat and power company in all its branches. The subscribers (each with one share) are:—H. G. Judd, 8, Fredericks Place, E.C.2, chartered accountant; P. Challis, 3a, Calle de San Geronimo, No. 31 bis, Mexico, D.F., engineer. The first directors are to be appointed by the subscribers. No share qualification required. Solicitors: Stephenson, Harwood and Tatham, 16, Old Broad Street, E.C.2. The registered office is at 8, Fredericks Place, Old Jewry, E.C.2.

Luminax, Ltd. (204,884).—Private company. Registered March 28th. Capital, £5,000 in £1 shares (3,000 10 per cent. non-cumulative preference and 2,000 ordinary). Objects: To carry on the business of electrical engineers, manufacturers and vendors of and dealers in wireless and electrical apparatus, &c. The subscribers (each with one share) are:—W. Sanders, 3, Cranbrook Road, Wimbledon, S.W., engineer; S. G. W. Norton, 25, Spencer Road, South Croydon, engineer. The first directors are to be appointed by the subscribers. Remuneration, £52 each per annum. Solicitors: G. H. Olley & Co., 11, Queen Victoria Street, E.C.4. Registered office: 553, Mansion House Chambers, 11, Queen Victoria Street, E.C.4.

C. T. Colbery & Co., Ltd. (204,989).—Private company. Registered April 2nd. Capital, £750 in £1 shares. Objects: To acquire the business of a scientific instrument maker and manufacturer of and dealer in wireless accessories now carried on by C. T. Colbery at 8, St. James' Walk, Clerkenwell Green, E.C., as "C. T. Colbery & Co.," and to carry on the business of manufacturers and importers of, agents for and dealers in scientific, electrical, optical, engineering, medical, telegraphic and wireless instruments and apparatus, &c. The permanent directors are:—C. T. Colbery, 83, Eastcombe Avenue, Charlton, S.E.7; C. Hudson (chairman), 35, Wellington Street, W.C.2. Qualification, £50 shares.

N.K., Ltd. (205,021).—Private company. Registered April 3rd. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with A. W. Kimber and to carry on the business of manufacturers and sellers of electrical lamps and globes of all kinds, wires, fittings, shades and other accessories, &c. The subscribers (each with one share) are:—A. W. Kimber, Chevening, The Drive, Wembley Park, N.W.1, engineer; Winifred C. Harris, 16, Lessar Avenue, Clapham Common, S.W.4, clerk. The first directors are: A. W. Kimber (permanent) and H. Riddiough, address not stated. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, Strand, W.C.2.

Richson & Company (1925) Ltd. (204,945).—Private company. Registered March 31st. Capital, £15,000 in £1 shares. Objects:—To carry on business as manufacturers, merchants and dealers in electric light fittings, glassware, porcelain and goods of a like kind, importers, exporters, manufacturers' agents, &c. The subscribers (each with one share) are:—R. J. Cocks, 37, Lilleshall Road, Clapham, S.W.4, cashier; C. W. Munn, 42, Bourne Road, Bromley, Kent, rate collector. The first directors are A. Cutforth and A. G. White, addresses not stated. Qualification, 1 share. Solicitors: Rollitt, Sons & Haydon, 3, Mincing Lane, E.C.3.

Carter & Co. (Nelson), Ltd. (204,955).—Private company. Registered April 1st. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturing electricians and mechanical engineers, &c. The first directors are:—J. H. Carter, 50, Hibson Road, Nelson, electrical engineer; W. Duerden, 50, Hibson Road, Nelson, electrical engineer; F. Carter, 8, Vincent Road, Nelson, electrical engineer. Qualification, 250 shares. Secretary: F. Carter. Solicitor: H. Ogden, 5, Grimshaw Street, Burnley. Registered office: 37, Manchester Road, Nelson.

Scottish Mica Co., Ltd. (13,581).—Private company. Registered in Edinburgh March 25th. Capital, £1,000 in 5s. shares. Objects:—To carry on the business of mica and mineral importers, merchants and agents, &c. The first directors are:—Wm. H. Findlay, Old Manse, 98, High Street, Rothesay, mica merchant; A. Thorburn, Conestmore, Rothesay, bank agent; W. Johnstone, Bankside, Giffnock, Glasgow, solicitor. Qualification, 100 shares. Secretary: A. G. McBain. Registered office: Ladiside Street, Rothesay.

Normand Electrical Co., Ltd. (204,961). — Private company. Registered April 1st. Capital, £7,000 in £1 shares. Objects: To carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, apparatus, novelties and specialities. The subscribers (each with one ordinary share) are:—W. Scott, 13, Edwardes Square, W.8, electrical engineer; R. E. A. Mallet, Redford, Ockley, Surrey, research chemist; Mrs. E. M. Scott, 13, Edwardes Square, W.8. The permanent directors are:—W. Scott (managing director) and Mrs. E. M. Scott. Qualification (except first directors), 200 shares. Remuneration as fixed by the company. Secretary: Mrs. E. M. Scott. Registered office: 35-37, Macaulay Road, Clapham Common, S.W.4.

Pinnacle Switchgear, Ltd. (205,032).—Registered April 3rd. Capital, £21,000 in 20,000 cumulative 10 per cent. participating preference shares of £1 and 20,000 ordinary shares of 1s. Objects: To carry on the business of mechanical and electrical engineers, manufacturers of machinery and electrical equipment, &c. Minimum cash subscription, 7 shares. The first directors are:—A. W. Little, "Avonhurst," Freshford, near Bath, Somerset, stockbroker; T. Symington, 99, Streathbourne Road, S.W.17, solicitor. Qualification, £500. Remuneration, £100 each per annum (chairman £125). Law agent: L. Blair, 94, Hope Street, Glasgow. Registered office: 64, Victoria Street, S.W.1.

Official Returns of Electrical Companies.

Perfect Burglar Alarm Co., Ltd. (112,522).—Return dated December 16th, 1924. Capital, £4,000 in 1,000 preference and 3,000 ordinary shares of £1 each. 230 preference and 1,710 ordinary shares taken up. £1 per share called up on 1,210 and 1/- per share—on 330 shares. £1,382 10s. paid. £500 considered as paid on 500 shares. Mortgages and charges, nil.

Turner, Atherton & Co., Ltd. (66,901).—Return dated August 15th, 1925 (filed February 10th, 1925). Capital, £140,116 in 62,861 preference and 77,253 ordinary shares of £1 each. 49,172 preference and 51,597 ordinary shares taken up. £26,487 paid on 7,259 ordinary and 19,228 preference shares. £74,282 considered as paid on the remainder. Mortgages and charges, nil.

Simplex Conduits, Ltd. (88,290).—Return dated November 6th, 1924. Capital, £100,000 in 50,000 ordinary shares of £1 each and 10,000 preference shares of £5 each. 40,000 ordinary and 10,000 preference shares taken up. £50,000 paid on 10,000 preference shares. £40,000 considered as paid on 40,000 ordinary shares. Mortgages and charges, nil.

W. G. Cannon & Sons, Ltd. (87,796).—Return dated December 22nd, 1924. Capital, £3,000 in £1 shares. All shares taken up. £9 paid. £2,991 considered as paid. Mortgages and charges, nil.

Davies, Kent & Stewart, Ltd. (81,627). — Return dated December 28th, 1924. Capital, £3,500 in 2,500 preference and 1,000 ordinary shares of £1 each. 1,974 preference and 1,000 ordinary shares taken up. £2,974 paid. Mortgages and charges, £1,050.

Montevideo Telephone Co., Ltd. (27,208).—Return dated November 19th, 1924. Capital, £220,000 in £1 shares. 217,135 shares taken up. £217,135 considered as paid. Mortgages and charges, nil.

Douglas Southern Electric Tramways, Ltd. (45,701).—Return dated December 24th, 1924. Capital, £50,000 in 30,000 preference and 20,000 ordinary shares of £1 each. 25,973 preference and 15,472 ordinary shares taken up. £18,370 paid on 12,566 preference and 5,804 ordinary shares. £23,075 considered as paid on 13,407 preference and 9,668 ordinary shares. Mortgages and charges, £1,376 13s. 6d.

Harrow Electric Light & Power Co., Ltd. (44,529).—Return dated March 5th, 1925. Capital, £50,000 in 6,667 ordinary and 3,333 preference shares of £5 each. All shares taken up. £50,000 paid. Mortgages and charges, £25,000.

Wireless Novelties, Ltd.—Debenture dated February 24th, 1925, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. Nicoll, 29, High Street, Clapham, S.W.

C. J. Thursfield & Co., Ltd.—Second mortgage debenture dated March 19th, 1925, to secure £750, charged on the company's undertaking and property, present and future, including uncalled capital and unpaid calls. Holder: R. C. S. Jamie, 106, Trafalgar Road, Moseley, Birmingham.

Wireless Experts, Ltd.—D. V. L. Craddock, of 2, Forbury, Reading, chartered accountant, was appointed receiver on March 20th, 1925, under powers contained in debenture dated December 10th, 1925.

Llanelly and District Electric Supply Co., Ltd.—Satisfaction in full on or before February 25th, 1925, of mortgage and charge by way of trust deed dated January 24th, 1922, securing £125,000 debenture stock, together with £2,500 of premium.

Burndept, Ltd.—Satisfaction in full on December 2nd of charge dated February 4th, 1924, securing all moneys not exceeding £25,000.

Radio Company of Great Britain.—A memorandum of satisfaction in full on March 30th of debentures dated March 20th, 1925, securing £240,000, has been fixed.

Cleveland and Durham Electric Power, Ltd.—Satisfaction to the extent of £10,300 on various dates between May 6th, 1924, and March 19th, 1925, of debentures, secured by trust deed dated October 6th, 1913, and December 31st, 1918, securing £250,000.

River Plate Electricity Co., Ltd.—Satisfaction in full on March 19th, 1925, of trust deeds dated January 8th, 1903, and June 22nd, 1914, securing £250,000.

Kingolite Co., Ltd.—Satisfaction (a) to the extent of £250 on February 28th, 1925, of debentures dated July 9th, 1914, securing £400, and (b) to the extent of £310 on February 28th, 1925, of debentures dated May 1st, 1918, securing £400.

Hills Wireless Stores, Ltd. — W. M. Gough, L.A.A., of 188, St. Paul's Road, Highbury, N.1, associated accountant, was appointed receiver and manager on March 28th under powers contained in debentures dated February 11th, 1925.

Carey Hallewell & Co., Ltd.—Mortgage debenture dated March 25th, 1925, to secure all moneys due or to become due, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. L. Stacey, 70, Station Road, Barnes, S.W.13.

City Notes.

Prospectus.

Burndept Wireless, Ltd.—The list of applications was to close on Wednesday (but it actually closed on Monday for London) in an issue of 285,000 7½ per cent. preferred ordinary shares of £1 each at par in this company, particulars of which appear in our "New Companies Registered" section to-day. The whole of 600,000 deferred ordinary shares of 1s. each have been allotted, and 130,000 of the above preferred ordinary had been applied for before the prospectus was advertised. The preferred ordinary shares are entitled to 50 per cent. of the additional distributed profits, but until reserves equal to £100,000 have been created, a minimum of 20 per cent. of the profits remaining after the fixed cumulative preferential dividend has been paid, is to be placed to reserve before any additional distributions are made. The purchase price payable to the vendors, The Radio Company of Great Britain, Ltd. (see Elec. Rev., April 3rd, p. 544), is £165,000, of which £14,799 is for goodwill, payable in cash. The vendors have applied for the whole of the deferred ordinary shares mentioned above, and they and the directors and their friends have applied for the 130,000 preferred ordinary also alluded to. It is stated that after the payment of the purchase price, there will remain £150,000 as additional capital, £60,000 of which will be applied by the company in the subscription of 60,000 ordinary shares of £1 each in Radio Accessories, Ltd. The prospectus contained a profits statement showing that for the year ended March, 1923, with a capital of £35,000 there were sales of £119,898 and profits amounting to £21,290; for the following year, with the same capital, the sales were £192,587, but the profits fell to £15,639; and for the nine months ended December, 1924, with a capital of £88,222, the sales were at the rate of £355,541 per annum, and the profits at the rate of £63,344 per annum. A statement is made by the managing director, Mr. W. W. Burnham, regarding the profits expected in the future. The fall in profits for the year ended March, 1924, is ascribed to the company's action in replacing at its own cost a large number of receiving sets to suit the altered Post Office regulations, in order to maintain the goodwill of the business.

Bournemouth and Poole Electricity Supply Co., Ltd.

Mr. J. A. Hosker (chairman), in moving the adoption of the report and accounts (*vide* Elec. Rev., March 27th, p. 506), at the annual meeting on March 31st, said that marked progress had been made during the past year. The receipts from the sale of energy, &c., had increased by 15 per cent. and the directors had been enabled to pay the same dividend and a larger bonus, and to transfer more to reserve. The sales of energy had increased by 13 per cent. to 9,176,358 kWh, and the generating costs had been lowered by 21 per cent. In view of the near approach of the end of their tenure of powers to supply in parts of their area, negotiations had been opened up with the Bournemouth, Poole and Christchurch Corporations, and these bodies had appointed an expert to consider the question of extending the company's tenure. Such an extension would enable the company to go ahead with improvements which would lead to considerable reductions in the charges to consumers.

Melton Mowbray Electric Light Co., Ltd.

Mr. F. E. Gripper, presiding over the annual meeting, on March 26th, said that notwithstanding the reduction of prices that had been enforced during the last 12 months, the revenue had slightly increased. Additional mains had been laid in the town at a cost of nearly £3,000, and the company had a new turbo-generator on order at a cost of nearly £14,000, which would be installed during the present year. They had issued £10,000 in share capital during the year, and proposed to increase the capital to £60,000 by the creation of 4,000 new shares of £5 each. The accounts showed a net revenue of £5,815. An interim dividend of 4 per cent., free of tax, was paid in November last, and the directors recommended a further dividend of 6 per cent. £2,000 is to be transferred to general reserve, leaving a balance of £752 to be carried forward.

Llandudno and Colwyn Bay Electric Railway, Ltd.

The annual meeting of this company, whose report was dealt with in our last issue, p. 547), was held on April 2nd. Mr. A. W. Tait, C.B.E., chairman, who presided, said that the results of the past year's year's working were disappointing. This was due both to the bad weather and to the increasing motor-'bus competition. With regard to the latter, there were 14 competing 'buses last year, as compared with six in 1923. The ratio of expenses to receipts had risen from 77.3 to 89.6 per cent. New motors and controllers had been fitted in all the large cars, and the feeder system had been improved. The company had not yet been successful in inducing the Llandudno Council to reduce its charges for power, but negotiations in this connection were proceeding. It was difficult to make a forecast of the future, although the company was doing everything in its power to improve the system. If the weather was favourable the results would probably be better this year.

German Companies.

The *Wolfram Lamp Company*, of Augsburg, the chief shareholder in which is the Osram Company, of Berlin, recommends a dividend at the rate of 6 per cent. for 1924.

The *Miz and Genest Company* intends to pay a dividend at the rate of 8 per cent. for 1924 on the share capital of 7,000,000 Reich marks.

The *Elevated and Underground Electric Railway Company*, of Berlin, has decided to convert the capital from paper to a Reich mark basis so that the total ordinary and preference shares will amount to 113,294,000 marks as compared with 80,000,000 marks in 1914. It is proposed to pay a dividend at the rate of 5 per cent. on the reduced capital for 1924.

Belgian Companies.

La Société d'Electricité de l'Escaut, of Antwerp, reports a net profit of 6,554,281 fr. for the last financial year, as compared with 4,255,324 fr. in 1923. The directors are placing 327,714 fr. to reserve, 472,656 fr. to statutory allocation, and distributing 3,700,000 fr. among the shareholders, leaving a balance of 53,910 fr. to be carried forward.

The *Société Générale d'Entreprises Electriques* states that the net profits realised in 1924 amounted to 3,502,000 fr., as against 3,152,000 fr. in the preceding year. The net rate of distribution has been fixed at 46.75 fr. per ordinary share as compared with 42.50 fr. in 1923.

French Companies.

The *Société du Centre Electrique*, out of net profits of 2,432,000 fr. for 1924, proposes to distribute a dividend of 12 per cent. In 1923 the profits were 1,408,000 fr. and the dividend 10 per cent.

The *Société des Produits Chimiques et Electro-Metallurgiques Alais, Froges et Camargue*, proposes to pay a dividend at the rate of 8 per cent. as against 7 per cent. in 1923.

The *Société de l'Electrification Industrielle*, which increased its turnover from 2,216,000 fr. in 1923 to 5,103,000 fr. last year, reports net profits of 704,000 fr., permitting of a dividend of 10 fr. per share for 1924.

The *Société Francaise des Electrodes*, of Lyons, reports gross profits of 1,686,000 fr. as compared with 1,072,000 fr. in the previous year. A dividend of 10 per cent. is being paid.

Bath Electric Tramways, Ltd.—The annual meeting of this company was held on March 31st. Mr. E. H. R. Trenow, who presided, said that the company had had a strenuous year owing to the bad weather, and, in addition, fares had been reduced. Referring to the heavy costs of operation, Mr. Trenow said that these were rather more than double the pre-war figure and yet the net revenue remained about the same. The company's track was in excellent condition, and the financial position was sound. Appearances suggested that the company was on the way to better times. The report and accounts were adopted and a dividend of 2½ per cent. on the preferred ordinary shares was approved.

Buenos Ayres Lacroze Tramways Co.—The gross receipts during the year ended June 30th last were rather higher at $8,490,615, but the expenses rose in greater ratio, reducing the amount available to $2,273,454. After providing for debenture interest, &c., $34,911 was placed to reserve and $630,000 distributed among shareholders. The sum of $24,420 is carried forward.

Hastings and District Electric Tramways Co., Ltd.—Out of the profits for the past year it has been decided to allocate £2,500 to depreciation and £500 to the reduction of the suspense account, and to pay a dividend of 2½ per cent. (as in 1923) on the ordinary shares, leaving £1,285 to be carried forward.

Bromley (Kent) Electric Light & Power Co., Ltd.—After providing for debenture interest, depreciation, &c., the balance from 1924 was £13,139 (including £783 brought forward). An interim dividend of 4 per cent. has been paid and a further 6 per cent. is recommended, both free of tax. The general reserve receives £3,500, and £639 is carried forward.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be officially quoted :—

Westminster Electric Supply Corporation.—755,620 ordinary shares of £1 each, fully paid, Nos. 1 to 755,620, and 550,000 4½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,200,001 to 1,750,000.

Northern Electric Co.—This Canadian company reports an increased business during 1924. The profit for the year was $1,322,319, and total dividends of 10 per cent. have been paid (as against 7 per cent.). The total surplus at the end of the year was $2,174,104.

American Telephone and Telegraph Co.—It is reported from New York that the stockholders have authorised the increasing of the capital stock from 1,000 million to 1,500 million dollars.

Anglo-American Telegraph Co., Ltd.—The following dividends have been declared for the quarter ended March 31st :—Ordinary stock 15s. per cent.; preferred stock £1 10s. per cent.

English Electric Co., Ltd.—A dividend of 5 per cent. has been declared on the ordinary shares for the past year. The 1923 dividend was the same.

Westminster Electric Supply Corporation, Ltd.—The company's £5 shares have now each been divided into five £1 shares in accordance with the resolution recently passed and confirmed.

Babcock & Wilcox, Ltd.—A final dividend of 5 per cent., free of tax, and a bonus of 2 per cent. (making 12 per cent. for the year, as in 1923) have been announced.

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary :—

Central Electrical Engineering Co., Ltd.
Northern Electrical Manufacturing Co., Ltd.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved :—

Charmlyn Electrical Co., Ltd.
Manchester Electro-Mechanical Repairs, Ltd.
Portmadoc Electrical and Wireless Supplies Co., Ltd.
St. Helens Motor and Electrical Engineering Co., Ltd.
Shropshire Electrical and General Engineering Co., Ltd.
Standard Wireless Supplies, Ltd.
Union Wireless Co., Ltd.
Wimbledon Electrical Co., Ltd.
Wireless Corporation, Ltd.

Cork Electric Tramways and Lighting Co., Ltd.—The revenue for 1924 was £136,653, and after debiting working expenses there was a balance of £38,869. From this debenture interest is paid, £15,000 is put to reserve for depreciation and renewals, and £3,000 is transferred to general reserve, leaving a balance of £20,726. Preference and interim ordinary dividends absorb £9,613, and it is proposed to pay a final dividend of 3 per cent. on the ordinary shares (making 6 per cent.), and to carry forward £7,663. While the lighting and power revenue increased, that from the tramways was smaller, owing to fare reductions. Two old 750-kW sets have been replaced by a 2,000-kW turbo-alternator to meet the additional demands.

The Tata Companies.—Messrs. Tata & Sons, the managing agents of the hydro-electric companies in Western India, have issued a statement to their shareholders containing an account of the financial position of the companies and their prospects, and inviting the shareholders to subscribe the additional capital of Rs. 1¼ crores now needed for the completion of the Tata Power Co. works. The estimated value of all the companies together is Rs. 17 crores. Contracts for the supply of the power on behalf of all the companies have already been entered into with transport agencies at favourable rates for periods of from 10 to 15 years, and it is expected that the total revenue therefrom will be Rs. 230 lacs, from which, after deducting the expenditure, Rs. 170 lacs will remain for distribution among shareholders.

Bombay Electric Supply and Tramways Co., Ltd.—The report for the year 1924 shows gross earnings of Rs. 145 lacs, while the total expenditure was Rs. 79 lacs. After providing for depreciation, interest, and reserve, the net profits available for distribution are Rs. 42 lacs, and a dividend of 10 per cent. has been declared on the ordinary shares. The electricity supply branch improved its earnings, but the tramway branch returns fell. Owing to a dispute between Bombay Corporation and the company in connection with the question of increasing the fares, no extensions were made during the year, nor will any be opened until the fare question is settled. Capital expenditure during the year amounted to Rs. 14¼ lacs.

Lancashire Dynamo and Motor Co., Ltd.—After providing for debenture interest and depreciation, the profit for the past year was £14,320, and the addition of £211 brought forward makes available £14,531. It is proposed to distribute this as follows :—Preference dividends, £2,080; ordinary dividend (5 per cent.), £6,747; directors' fees, £500; transfer to reserve, £5,000; carried forward, £204. The results were better than those of the previous year and the number of orders at present in hand is greater than at the same period last year. The "Crypto" agreement continues to work satisfactorily in the interests of both companies. Provision has been made for the estimated liability of the company to excess profits duty, &c.

London Electric Wire Co. and Smiths, Ltd.—The directors state that there was an improvement in output during the past year, although a large proportion of the work had to be undertaken at cut prices. Out of the year's profits £50,000 is transferred to special reserve, a final dividend of 6¼ per cent. (making 7½ per cent. for the year) is paid on the ordinary shares and £41,773 is carried forward. Meeting held April 7th.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have fallen into the condition of lassitude that is customary in the week before Easter. The public are more intent upon holiday arrangements than they are upon investment or speculation. The money market is quiet, and the little scare which took place at the end of March is now passing away; the high rates which are quoted every now and then for financial accommodation refer to comparatively small sums. Prices are steady as a whole, and in the list of electricity supply companies, the movements on the week are insignificant. The proceedings of the Select Committee of the House of Commons have attracted considerable attention. As generally expected, the Committee passed the three Bills promoted by the London electricity supply companies and ordered them to be reported to the House of Commons.

Bournemouth and Poole ordinary at 55s. are ex the dividend and bonus of 1s. 10 4/5d. per share. Amongst other provincial issues, Folkestones are strong at 40s. Newcastle-on-Tyne ordinary and both preference issues are quoted ex the dividends. Edmundsons stiffened to 23s. 6d. St. James's and Pall Mall rose ¼ to 13¼. Westminsters no longer appear in the Official List in their previous shape of £5. The shares are being dealt in indifferently, at 10 11/16 for the old; at 43s. for the £1 shares. The Egham and Staines dividend is again to be 7½ per cent.

Underground Railway stocks are quiet, Central London ordinary with a fall of a point being the only one of the Tube group to show any change on the week. The Southern Railway opened its new extension last week with a flourish of trumpets, and a freakish breakdown which led to a good deal of amusement on the part of all except those passengers who suffered the loss of an hour or so in consequence. London United Tramways 4 per cent. debenture stock is down 2 points at 47½. British Columbia Electric Railway stocks continue flat, the recent shrinkage in these securities arousing a certain degree of anxiety amongst those who do not realise the closeness of the sympathy that links, in the minds of investors, Canadian affairs with those of the adjacent province. Anglo-Argentine Tramways 5 per cent. debenture stock fell 2½ to 73, a good deal of stock coming to market on the basis of 73½.

Several of the Indian companies have published their reports during the past few days. The Andhra Valley Power Supply Company shows a loss on the year ended June 30th, 1924, this being attributed mainly to delay by customers in taking supply. The company's 7½ per cent. Ten-year Secured Sterling Notes are quoted 96½ ex the interest payment due on the 1st of this month. The Tata Hydro Electric Company's report announces a dividend of 7 per cent. free of tax on the ordinary shares. The Tata Power Company issued a report the other day which led to misapprehension in regard to a postponement of the payment of interest out of capital for the year. The statement referred, according to the company's subsequent notice, to the interest that it is authorised to pay on the share capital during the course of construction, and had nothing to do with the payment of interest on the debenture stock, as some people feared might be the case. Tata 4½ per cent. guaranteed "A" debenture stock which comes into the category of the Trade Facilities Acts securities, is quoted 95 middle, while the 7½ per cent. "B" mortgage debenture stock stands about 93¼, two or three bargains having been done early this month at 91.

At the Bath Electric Tramways meeting, the chairman expressed the hope that the company was on its way to better times. The preferred ordinary shares, it may be mentioned, of the nominal value of £1 each fully-paid, stand at about 5s. and the company's 5 per cent. cumulative preference at 13s. 3d., while the 4½ per cent. first mortgage debenture stock is quoted at 71, the last recorded transaction being at 74½ on March 11th, when the price was still *cum* dividend.

The cable list is very quiescent, the only change of importance being recovery of its 50s. per cent. quarterly dividend by Eastern Telegraph ordinary stock. This leaves the quotation at 176½, at which the yield on the money is £5 13s. 4d. per cent., equivalent to 7½ per cent. taking tax at 4s. 6d. in the £. The cable manufacturing group is quiet, Henleys, Callenders and British Insulated holding their recent rises, the last-named shares at 3 1/16 ex dividend. India Rubbers strengthened to £1, and Johnson & Phillips to 32s. 6d. A good deal of curiosity is felt regarding the dividend to be announced shortly by the General Electric Company. Last year it was 5 per cent., and cautious people suggest 7½ per cent. as a likely dividend for the twelve months recently ended. Optimism expects it will be more. The London Electric Wire Company and Smiths repeats the 7½ per cent. dividend paid in the two preceding years. Net profits rose substantially, and the balance sheet discloses a strong position.

Mexicans are flat, the Tramways Company 5 per cent. bonds losing 2, Mexican Light preferred 3½, and the Company's bonds 2. Brazil Tractions have gone back to 54.

Marconis are not a very good market, there being sellers at 34s. Canadians eased off to 5s. 3d. offered: the new shares are now in competition with the old. The new command a small premium over their issue price. Telephone shares are steady; Venezuelans at 21s. 6d. show a small advance.

The electrical manufacturing list is dull. English Electrics, General Electrics, and Edisons have been heavy. The rumour that the Edison Company is to be absorbed by another undertaking, has died from inanition. British Aluminium 5 per cent. prior lien bonds have hardened to 97½. Babcock & Wilcox fell back to 52s. 6d., there being some little disappointment at the dividend being repeated at 12 per cent., tax free, when 15 per cent. had been anticipated in some quarters. The rubber share market continues strangely quiescent, considering the rise in the price of the produce.

The final details in connection with the transfer of the East London Railway to the Southern Railway are thought likely to be settled in about three months' time. Certain formalities have to be passed by Parliament, but it is assumed that the East London will have ceased to exist as a separate entity by the end of July.

Vickers were hardly expected to pay any dividend on the ordinary shares this spring, and the official declaration, confirming this, merely made the price a little easier at 8s. 7½d. The iron and steel group cannot throw off its depression. Sir Robert Horne's lugubrious speech last week upon the subject of important national trades was not calculated to encourage bullishness in connection with share purchases.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price April 6 1925.	Rise or fall.	Yield. p.c.
Bournemouth and Poole ...	1	13	14	2¼xd	+ ⅛	£ 1 10
Brompton Ordinary	1	10	10	1½xd	—	*5 10 4
Charing Cross Ordinary	1	14½	15	45/-	—	6 13 4
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	38/9xd	+ ⅛	6 4 0
City of London	1	15	15	46/9xd	—	6 8 2
do. do. 6% Pref. ...	1	6	6	23/6xd	+6d.	5 2 2
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	15	15	43/9	—	*5 11 6
do. do. 6% Pref. ...	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	—	23/6	+6d.	5 19 2
do. 7% Pref.	1	6	—	23/-	—	6 1 9
Elec. Supply Corporation ...		10	10	31/3xd	—	6 8 0
Kensington Ordinary	5	14	15	12⅝	—	5 18 10
Lancs. Light and Power ...	1	7½	7½	27/6	—	5 9 1
London Electric	1	10	10	36/6	—1/-	5 9 7
do. do. 6% Pref. ...	5	6	6	5½	—	5 9 1
Metropolitan	1	10	11	38/3	—	5 15 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 3
Newcastle-on-Tyne Ordinary ...	1	6	7	23/9xd	+6d.	5 17 11
do. 5% Pref. ...	1	5	5	18/9xd	+4½d.	5 6 8
do. 7% Pref. ...	1	7	7	25/6xd	+6d.	5 9 10
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	1¼	—	5 6 8
St. James' and Pall Mall ...	5	17½	17½	13½	+ ½	6 12 1
South London	1	15	15	2½xd	—	6 0 0
South Metropolitan Pref. ...		7	7	1¼	—	5 12 0
Urban Ordinary	1	4	—	1⅛	—	3 15 4
do. 6% Pref. ...	1	6	—	20/6	—	5 17 1
Westminster Ordinary	5	15	15	10½	—	7 2 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/9	—	7 12 11
Yorkshire Elec.	1	8	8	30/-	—	5 6 8

Home Rails.

Central London Ord. Assented Stock	4	4	60	—1	5 15 11
Metropolitan ... ... ,,	4	5	78½	—	6 7 5
do. District ... ... ,,	3½	3½	49	—	7 2 10
Underground Electric Ordinary	10	Nil	Nil	2⅜	—	Nil
do. do. "A" ...	1/-	Nil	Nil	8/-	—	Nil
do. do. Income	Bonds	6	6	97	—	*6 8 9

Telegraphs and Telephones.

		Dividend. 1923.	Dividend. 1923.			
Anglo-Am. Tel. Pref.	Stock	6	6	105	—	5 14 3
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	Nil	3	1¾	—	3 8 7
Chili Telephone	5	6	6	5½	—	*5 9 1
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	17½xd	—	*5 14 3
Eastern Tel. Ord.	Stock	10	10	176½xd	+2½	*5 13 4
Globe Tel. and T. Ord.	10	10	10	18	—	*5 11 1
do. do. Pref.	10	6	6	11¾	—	5 7 10
Great Northern Tel.	10	24	22	33	—	6 17 6
Indo-European	25	7	7	8½	—	*5 6 1
Marconi	1	15	10	1¾	—	5 14 6
Marconi Marine	1	10	10	1¾	—	8 17 10
Oriental Telephone Ord. ...	1	12	12	2⅜	—	*5 12 11
United R. Plate Tel.	5	8	8	7	—	*5 13 0
Western Telegraph	10	10	10	17½	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	3½	—	8 9 2
do. do. 2nd Pref. ...	5	5½	6	3	—	10 0 0
do. do. 5% Deb. ...	Stock	5	5	78	—2½	6 17 0
British Electric Traction Ord. ...	,,	5	6	104½	+2	5 14 10
do. do. 6% Pref. ...	,,	6	6	105½	—	5 13 9
Brazil Traction	100	4	4	54	—1	7 8 2
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	89½	—1	5 11 9
do. do. Preferred	,,	5	95/-	88½	—	*5 8 4
do. do. Deferred	,,	8	129/5	106½	—	*6 1 6
do. do. Deb.	,,	4½	4½	79½	—	5 6 11
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	5/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	47½	—2	8 8 5
Mexico Trams, 5% Bonds ...	—	Nil	5	6¾	—2	7 7 1
Mexican Light Common ...	100	Nil	Nil	20	—	Nil
do. Pref.	100	Nil	Nil	57	—3½	Nil
do. 1st Bonds ...	—	5	5	67½	—2	7 8 2
Yorkshire (West Riding) ...	1	—	5	1	—	5 0 0

Manufacturing Companies.

Babcock & Wilcox	1	20	12	52/6	— ½	* 4 11 5
British Aluminium Ord.	1	5	5	83/3xd	+1/-	3 0 2
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	3½xd	—	4 17 11
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3½	—	4 13 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	1¼	—	... ...
Edison-Swan	4/-	7½	10	7/6	—3d.	5 6 8
do. 5% Deb.	Stock	5	5	81½	—	6 0 8
Electric Construction	1	10	10	33/9	+ ½	5 19 10
Enfield Cable, Pref.	1	7½	7½	1¾	—	6 0 0
English Electric	1	5	5	18/9	—1/3	5 6 8
do. do. Pref.	1	6	6	21/-	—	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/-	—6d.	5 13 1
do. Ord.	1	5	5	23/-	—	4 16 11
Henley	1	15	15	3⅛	—	4 14 1
do. 4½% Pref.	5	4½	4½	4¾	—	5 6 0
India-Rubber	1	10	5	30/-	+6d.	*5 0 0
Johnson & Phillips	1	5	5	1⅜	+ ⅛	3 1 6
Met-Vickers, Ord.	1	12½	8	24/6	—	6 10 6
do. Pref.	2	8	8	2½	—	6 8 0
Siemens Ord.	1	5	—	26/6	—	5 15 6
Telegraph Construction	12	20	20	27	—	*4 14 1

* Dividends paid free of Income Tax.

Intervalve Transformers.

The Amplification of Audio-Frequency Vibrations.

By C. H. NAYLOR, A.M.Inst.C.E.

THE study it is proposed to pursue in this article, is the use of intervalve transformers for the purpose of amplifying the audio-frequency vibrations between valves. The usual application is shown in fig. 1.

The problem of the equal amplification of audio frequencies between the grid of V_1 and the grid of V_2 by means of an intervalve transformer cannot rightly be considered from the point of view of the transformer alone. The subject must be treated as a combination of one valve and a transformer.

A transformer may be designed to give a constant voltage ratio between the primary and secondary terminals over a wide range of frequencies, and yet when working in conjunction with a valve will not give an equal amplification between the grid of V_1 and the grid of V_2 over the same range of frequencies.

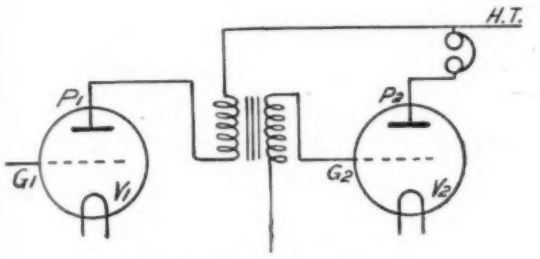


Fig. 1.—Application of Intervalve Transformer.

A transformer may faithfully pass on the e.m.f. changes of P_1 to G_2 in equal ratio over a wide range of frequencies, but this is not enough because the e.m.f. changes of P_1 are not necessarily in equal ratio to the e.m.f. changes of G_1 for different frequencies. The reason for this is that the e.m.f. changes of P_1 are accompanied by current changes, or to be more precise, the maximum e.m.f. value of the wave at P_1 may at any moment be constant, but, at the same time, there may be a change in frequency. This means a change of current whilst the e.m.f. change is remaining constant. Under these conditions, the e.m.f. changes of G_1 are not proportional to those at P_1 because of the current changes. In short, the e.m.f. amplification value of the valve does not remain the same when current values change. This will be more clearly seen by considering the valve characteristic curves, fig. 2.

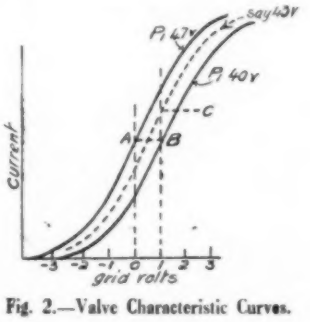


Fig. 2.—Valve Characteristic Curves.

Two curves are drawn corresponding to plate e.m.f.'s of 47 and 40 volts respectively. With an increase of one volt on the grid the plate e.m.f. would need to drop 7 volts in order that there might be no change of current, as will be seen from the diagram by the intersection points A and B.

This represents an amplification factor of 7, because one volt change on the grid gives a 7-volt change on the plate for no current change. This is the maximum possible e.m.f. amplification that can be got out of the valve in this case. If, however, there be an increase of current, say, from B to C when the grid e.m.f. rises one volt, then the plate e.m.f. curve would fall between the two full-line curves and would be as appears by the dotted curve. The change of plate volts now will not be as 7 to 1 as when there was no current change, but less, say, 4 to 1. The e.m.f. amplification of the valve, therefore, under the conditions of changing current may be anything from 0 to the maximum. The formula expressing valve amplification may be expressed by:—

$$FG = RC + e \qquad (1)$$

where F = the amplification factor of the valve, generally between 6 and 7, or even as much as 20.

R = the resistance in ohms of the valve, corresponding to the point on the curve from which F has been calculated.

C = momentary current change, amps.

e = momentary e.m.f. change on plate, volts.

G = momentary e.m.f. change on grid, volts.

The calculations are made on the R.M.S. value of e, C and G, but for explanatory purposes these momentary values may be taken to mean in all cases the maximum value of the sine wave at any instant, as shown in the following figure:—

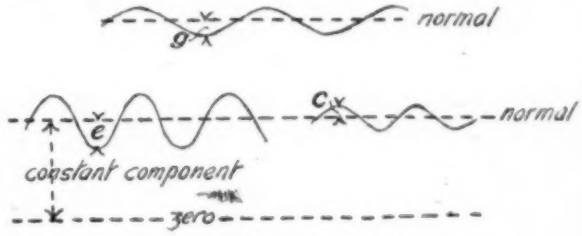


Fig. 3.—Sine Curves for c, e and g.

In the case of C and e, there is a constant component; the values of e and C, however, are taken as the maximum value of the wave from the normal, and throughout this article this lettering will always mean these values. Referring to fig. 2 and formula (1), it will be noted that when C=0 then FG=e, that is maximum e.m.f. amplification is attained. When e=0 then FG=RC, that is, no amplification of e.m.f. is attained.

Now, as previously explained, every change of potential at the terminals of the primary of an intervalve transformer entails also a change of current; this is quite all right for equal amplification provided the current change is proportional to the e.m.f. change. It is change of frequency which upsets this proportionality, because e.m.f. change of plate may be continuing constantly, but frequency may be changing as in the case of equal loudness but varying pitch of a musical note.

The transformer must be designed to meet this characteristic of the valve.

It will be obvious that one of the first things to look to is the reduction of current changes to as nearly negligible values as possible.

The author proceeded to investigate the theory of the transformer in conjunction with a valve with a view to arriving at the proper physical quantities necessary to obtain maximum amplification at all audio frequencies.

The investigations were made by means of vector diagrams. A formula could be constructed from the diagram, but it was found to be very complex if it expressed the diagram completely. When a diagram is drawn to actual calculated quantities, it is at once

evident that many of the quantities involved can be ignored as negligible, and, finally, the investigation became much simplified by using a formula in which the negligibles were eliminated. The complete vector diagram for an intervalve transformer and valve is shown in fig. 4, drawn out of scale for clarity.

The diagram, fig. 4, represents every effect that takes place from the grid of v_1 to the grid of v_2, except the capacity effects between the grid and plate of v_2, and between the primary winding and the secondary winding of the transformer. These effects must be taken care of outside this diagram, or reduced to a negligible quantity.

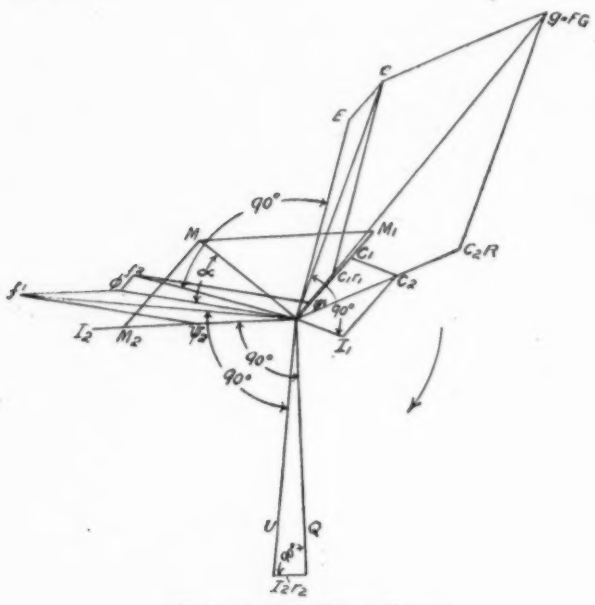


Fig. 4.—Intervalve Vector Diagram.

The capacity effect between grid and plate of v_1 is negligible, because the audio frequency is relatively low. The capacity effect between the primary and secondary windings can be made negligible by providing a sufficiently large annular gap between them. This, however, causes increased leakage flux in the secondary which, under certain conditions, is an advantage; but this point will be dealt with later.

Now proceeding with the explanation of the vector diagram, fig. 4, we assume a constant voltage on the grid of v_2, say, 10 volts. This voltage is represented by Q on the diagram. It does not matter whether this value is a reasonable one or not, for it will be seen that we are considering proportional voltages at G_1 and G_2. Keeping the value of Q always at 10 volts, we work back through the various vectors of the diagram and find the value g for a series of frequencies ranging from, say, $n=100$ to $n=3,200$. Now, $g=FG_1$, where G_1 is the grid volts of the v_1 and F the amplification factor of the valve (its maximum value); g is the vectorially added quantities $IC+e$, see formula (1), therefore, it is equal to FG_1. Having found G_1 with relation to Q, the overall amplification is then Q/G, and this, in the ideal case, should be the same, or nearly so, for all frequencies in the musical scale

From Q the voltage change at terminals of the secondary (and, therefore, G_2), we find I_2 the secondary capacity current. I_2 is the only current in the secondary, for we are assuming that there will be a sufficient negative bias on the grid of v_2, to prevent any current passing that way

$$I_2 = pK_2Q. \qquad (2)$$

Where I_2 = capacity current in amperes.
$p = 2\pi n$.
K_2 = secondary capacity in farads.
Q = 10 volts.
n = frequency.

I_2r_2 = volts drop across the secondary due to its own resistance r_2 in ohms.

I_2r_2 and Q drawn at right angles give a vector U, which is the impressed volts on the secondary, and which would require a magnetic flux change of f_1 to produce it. f_1 is at right angles to U and in advance.

$$f_1 = U \times 10^8/pT_2 \qquad (3)$$

Where f_1 = total flux change.
U is found from Q and I_2r_2.
T_2 = number of turns of wire on the secondary.

The capacity current in the secondary produces a magnetomotive force M_2, and leakage flux ψ_2.

$$M_2 = 4\pi T_2 I_2/10 \qquad (4)$$

In all cases magnetic flux is equal to magnetomotive force multiplied by $\mu a/l$.

Where μ = permeability of magnetic path.
a = area of path in sq. cm.
l = length of path in cm.

In the case of the leakage flux ψ_2, this being through air $\mu_2=1$. a_2=the area of the annular gap between primary and secondary, and part way through the secondary as shown in fig. 5. This is difficult to estimate, but an approximation can be made. l_2= length of path estimated from fig. 6. This is also difficult to estimate, but an approximation can be arrived at.

If $\mu_2 a_2/l_2$ for leakage gap in secondary = z_2, then $\psi_2 = M_2 \times z_2$.

It is necessary to estimate this leakage flux ψ_2 because it reduces the amount of flux required in the iron core, especially at high frequency, because I_2 becomes large.

The flux in the iron is ϕ, and is found by drawing vectors ψ_2, f_1.

The flux ϕ in the iron requires a magnetomotive force M to produce it. It will be seen that this value M is really the resultant of M_1 and M_2, the magnetomotive forces of primary and secondary respectively. M is, however, found from ϕ, and M_1 follows as a resultant.

M leads ϕ by an angle α, which is known as the angle of hysteretic lead. This angle of lead is due to the hysteresis losses and eddy current losses in the iron. A definite angle is known from the characteristic of the iron. For "Stalloy" the angle is about 30 deg., or

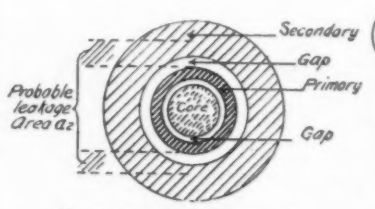


Fig. 5.—Indication of Area of Magnetic Path.

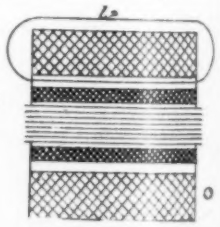


Fig. 6.—Indication of Length of Magnetic Path.

may vary slightly, depending on the induction to which the iron is worked.

$$M = \phi/(z \times \cos\alpha) \qquad (6)$$

Where $z = \mu a/l$ for the iron path.
μ = permeability about 3,800, or depending upon the induction in the iron.
a = cross section of iron path in sq. cm.
l = length of iron path in cm.
Cos 30 deg. = .866.

With regard to μ, the continuous component of current through the valve plays a part. Some dull emitter valves have a continuous component of 1.5 milliamperes, this gives a continuous magnetisation of the iron in one direction, and the alternating flux ϕ is a ripple on this. Some valves give a continuous component of current as much as 4 milliamperes, and the continuous induction in the iron is higher. The permeability μ in general decreases as the induction increases, so that, with a low-resistance valve the impedance effects in the transformer will be less, due to the reduced value of μ, and M will be greater for a given value of ϕ.

With regard to the value of l, if there be an air gap in the iron path

$$z = 1/(l/\mu a + l_a/a). \qquad (7)$$

Where l_a = total length of air gaps in cm., the

angle α decreases also, and may be 10 deg. with the usual air gap.

But it will be found that the smallest air gap will very considerably increase the value of M with relation to ϕ.

Having found M in direction and magnitude, we proceed to find M_1 which is the resultant vector of M_2 and M.

Now M_1 is the magnetomotive force which has to be provided by the primary current, with which it is in phase.

$$C_1 = M_1 \times 10/4\pi T_1. \qquad (8)$$

Where T_1 = number of turns on the primary.

C_1 = current in the primary.

Also in phase with M_1 is the leakage flux of the primary ψ_1. This can be calculated in the same way as was done for the secondary leakage flux.

$$\psi_1 = M_1 \times Z_1 \qquad (9)$$

where $Z_1 = \mu_1 a_1 / l_1$.

$\mu_1 = 1$.

a_1 = area of leakage gap in primary in sq. cm.

l_1 = length of leakage in cm.

By combining the vectors ϕ and ψ_1, we find the vector f_2, the total change of flux cutting the primary coils and requiring the e.m.f. E in volts at right angles to it.

$$E = p\ T_1\ f_2/10^8. \qquad (10)$$

In phase with M_1 and C_1, we find $C_1 r_1$, which is the current C_1 multiplied by the resistance of the primary winding.

Combining E and $C_1 r_1$, we find the vector e, which is the actual volts change at the terminals of the primary of the transformer, and also the volts change at the plate of valve V_1.

The primary of the transformer has also a capacity current, and this is shown by I_1 at right angles to e,

$$I_1 = pK_1 e \qquad (11)$$

where $p = 2\pi n$.

K_1 = capacity of primary in farads.

e = volts change at primary terminals.

Combining I_1 and C_1, we get the actual current change C_2 passing through the valve. Note, this is current change and does not include the continuous component previously referred to.

Therefore, for a given change of Q=10 at the grid of the second valve, we find a corresponding change of e at the plate of the first valve and the associated current c_2.

It will be noted that C_2 and e are not in phase, therefore the formula (1), $FG = C_2 R + e$, does not apply, unless these two values C_2 R and e are added vectorially.

On the C_2 vector we find C_2 R, which is the current multiplied by the resistance of the valve, and with C_2 R and e as vectors find the vector g. This vector g is equal to FG, for it is the resultant of adding C_2 R and e vectorially.

G_1 the volts change of the grid of V_1 is therefore equal to g/F, and the overall amplification is Q/G.

Now, it does not matter whether these several values are taken as maximum values of the sine curve or R M S values or what value may have been assigned to Q in the first instance, because the final result is a ratio, namely, Q/G_1.

This diagram shows clearly that some very important conclusions can be arrived at.

(To be continued.)

The Lighting of the Capitol Theatre.

In London's latest large kinema—the Capitol Theatre situated in Haymarket—every consideration has been given to make the building attractive, and to provide maximum comfort for its patrons; to this end the aid of electricity for lighting and power purposes has been invoked with a considerable measure of success.

The exterior lighting of the theatre is extensive. Surmounting the building is a large glass tower; this is illuminated at night time with "Osram" vacuum and gasfilled lamps. It is very prominent and can be seen from many directions at considerable distances. Immediately below the tower are fixed four bronze lanterns; these contain high-wattage gasfilled lamps. A number of fittings surmounted by flambeau glass shades containing gasfilled lamps are erected at the base of the tower, and on the top of the theatre; these, viewed from a distance, create an impression of the old-time brazier. At the front and sides of the theatre are fitted a number of massive bracket lanterns. Some of these are fitted in such positions as to form part of the symmetrical scheme with the lanterns previously referred to; other lanterns are spaced round the sides of the theatre at equidistant points.

On the front of the building the name of the theatre is displayed in daytime through the medium of box type letters; the interior of each box is painted red and is almost covered with a ruby coloured non-transparent material, a space being left between the edge of the material and the letter edges. Each box contains a number of Osram sign type lamps; when these are illuminated at night time the name of the theatre is to be seen outlined in what appear to be tubes of ruby coloured light.

Twelve "G.E.C." floodlights, equipped with 500-W round bulb projector type lamps, are fitted under the canopy over the entrance to the theatre. These are specially mounted to project beams of light through the top of the canopy at correct angles over the entire front of the theatre; the title panels under the canopy are illuminated with lamps fitted upon special battens.

The main entrance hall of the theatre (fig. 1) is illuminated by means of vacuum pear-shaped amber lamps and the booking hall is illuminated by two ceiling fixtures, similar in design to the one in the main entrance hall. The stairs leading to the booking hall are illuminated with bracket fitting and gasfilled

Fig. 1.—The Entrance Hall of the Capitol Theatre.

Fig. 2.—The Illumination of the Stalls.

lamps in suitable shades, while on the balustrade at the top of the stairs are fitted a number of lamps in glass shades of the flambeau type.

The decorative scheme of the interior of the theatre is in silver and grey, the upholstering being in purple; this scheme lends itself very readily to the decorative lighting effects which are arranged throughout the whole of the theatre in four colours, purple, blue, red and white.

The stalls, illustrated in fig. 2, are illuminated by one large ornamental centre fixture 9 ft. in diameter, and four smaller ones located round it. Concealed round the cornice are many hundreds of "Gecoray" reflectors fitted with lamps in the three colours, "Osram" "Striplite" providing the white light. The lighting arrangements are such that by means of switches and dimmers a charming system of colour mixing is obtained.

A special feature of the lighting arrangements is the installation of two ornamental fountains, one on either side of the auditorium. The decorative features of the auditorium lighting are supplemented by illumination immediately above the proscenium, by means of units formed of specially constructed battens of the compartment type fitted with gasfilled lamps; coloured diffusers provide four-colour lighting effects.

The boxes are illuminated by means of special ceiling fixtures of G.E.C. manufacture fitted with "Equiluxo" bowls. Although small, these are arranged to take twelve tubular type lamps, thus allowing for three lamps per colour which evenly illuminate the glassware.

The dome is illuminated by a large number of lamps concealed in the base. The effect is very attractive, the star-spangled dome being shown to advantage.

In the foyer the illumination is abundant and even; this is obtained through the medium of "G.E.C." pendants finished in Georgian silver with "Equiluxo" glassware equipped with gasfilled lamps; the corridors are illuminated by "Superlux" glassware ceiling fittings.

Below the theatre is a large dance hall where the lighting features are also extremely decorative.

One of the smaller applications of electricity, although quite an important one, is the method of indicating the positions of the seats. This indicator consists of an "Osglim" neon lamp which is let into each stair and covered with a rectangular diffusing glass upon which the number of the row is painted. The glass is fitted flush with the top of the stair, and when the lamp is switched on the letters stand out clearly against a background of soft, well-diffused light. In addition to their function as indicators, the lamps provide sufficient illumination

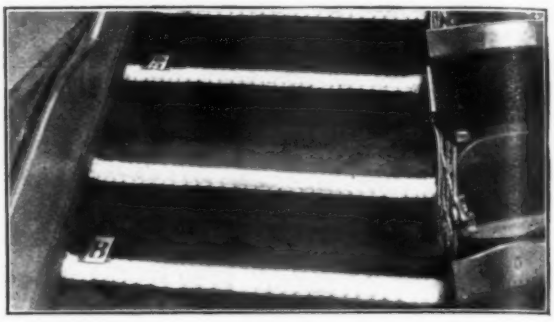


Fig. 3.—"Osglim" Seat Indicators.

to enable the stairs to be safely negotiated, and the services of an attendant can be dispensed with. A view of part of a staircase appears in fig. 3.

The lighting scheme described was designed by the Illuminating Engineering Department of the General Electric Company, Ltd., in collaboration with Mr. Ardrew Mather, the architect, and the entire installation was carried out by Messrs. Grierson, Ltd.

Anti-Friction Bearings.

Their Applications for Heavy Duty.

By J. B. DAHLERUS.

(*Abstract of Paper read before the* Institution of Mechanical Engineers.)

The fact that the speculation and extravagant claims made on behalf of anti-friction bearings have not always been borne out in practice does not necessarily condemn such bearings. Though progress in manufacturing methods has brought about a rapid improvement in the production of these bearings, designers have erred in giving the mechanics of the subject too much attention. They seemed to be interested chiefly in obtaining large contact areas, and neglected other essentials; the fatigue-resisting properties have to be defined, as well as load-carrying capacity.

The lower the coefficient of friction of the bearings the greater will be the power saving achieved. That an increase in production may be possible by fitting such bearings is not always obvious, but tests in some instances do prove that this is so and that the quality of the material passing through the machines is improved. The fact that less oil is used and that hot bearings are less likely to occur, will in some classes of work effect considerable reduction in maintenance charges. Oiling takes place only at infrequent intervals, and the amount of lubricant may be only one-tenth of that required with the ordinary bearing. To these factors may be added the certain advantage that there is less strain on belts and other moving parts, and the fact that anti-friction bearings have a starting resistance practically the same as the running resistance means that the reserve of power often required for starting becomes unnecessary, and machines may be speeded up to their normal rate of working in relatively short periods. The importance of considering the fatigue element is illustrated by an electric motor running at, say, 720 r.p.m. continuously; in twenty-four hours the total number of revolutions is just over one million, whilst the number of stresses at a given point in the outer race of the ball-bearing may be in the region of ten million.

The results obtained by the Midland section of the L.M. and S. Railway Co. in testing standard plain journals against roller axle boxes are discussed. The roller-bearing train is still in service to determine endurance, and the bearings are so far standing up to their work without the slightest sign of stress. On the Great Northern section a two-bogie passenger coach covered 141,476 miles and the bearings stood up very satisfactorily. In Great Britain 116 axle boxes are in service; in Australia 4; in America and on the Continent, including France, Sweden, Germany, Denmark, Finland, Czecho-Slovakia, and in Japan, over 3,000 are in service. The average cost of these roller-bearing boxes is about £20 each, complete with bearings and fittings, but, of course, the figure varies with the size and quantity required. Other applications in railway work include the return crank of Walschaert gear, train-lighting sets, and signalling apparatus.

Regarding applications to tram-cars, a fair amount of success with ball-bearing motors has been achieved in America and on the Continent, but in this country tramway engineers have a preference for the roller-type bearing, justified in a great number of cases, although ball-bearings have given satisfactory performance.

The arrangement referred to has the great advantage of being a simple two-bearing unit and the only complication is in the method of providing suitable protection, particularly at the pinion end. It is difficult to determine exactly what power saving is obtained, but the advantages of being able to keep the armature centred accurately in the magnetic field and of preventing it falling and fouling the poles are self-evident; many hundreds of motors have been so equipped. Tramway axles have to be removed fairly frequently for re-tiring the

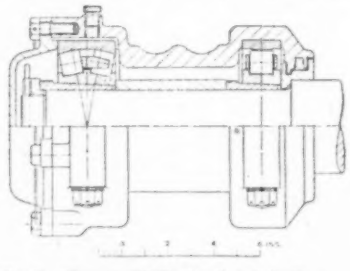


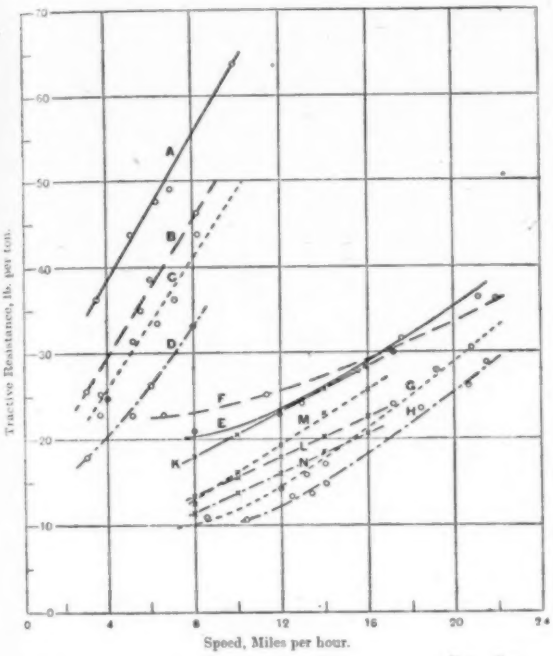
Fig. 1.—Tramcar Roller-bearing Axle Box.

wheels and it is necessary to remove the bearing boxes also. It is difficult to arrange for a sound locking scheme on account of restrictions regarding the overall dimensions of the boxes.

The design shown in fig. 1, which permits of sound mounting and the use of medium type bearings, is being tested at present and appears to have overcome the chief difficulties. To determine what power economy might be expected two manufacturers have had tests carried out by the National Physical Laboratory, and in the Glasgow Corporation car tests the percentage saving of electrical energy in favour of the roller-bearing car was definitely determined as 11.62 per cent. on the average, the minimum being 0.6 per cent. for one small section of the run, and the maximum 17.5 per cent. in another section. The tractive resistance at half load and at an average speed of 8 miles per hour gave a reduction of 22.6 per cent.

in favour of the roller-bearing car, 29.6 per cent. when unladen, and 14.9 per cent. on full load. At 16 m.p.h. the reduction at half load was 8.4 per cent., unladen 8.9 per cent., and on full load 8.4 per cent.

The starting effort for various loads indicated an average reduction of 79 per cent. and coasting tests made on an up gradient of 1 in 730, although the gradient was not uniform, showed the retardation of the plain-bearing car to be 0.49 ft. per sec. per sec. and that of the roller-bearing car 0.32 ft. The



					Ton.	Cwt.
A. Wigan	Test	Plain-Bearings	Empty	... ...	10	10
B.	,,	,, ,,	Loaded	... ...	14	10
C.	,,	Roller ,,	Empty	... ...	10	10
D.	,,	,, ,,	Loaded	... ...	14	10
E. I.C.C.	Test	Plain-Bearings.	Empty	... ...	15	17
F.	,,	,, ,,	Loaded	... ...	20	14½
G.	,,	Roller ,,	Empty	... ...	15	17
H.	,,	,, ,,	Loaded	... ...	20	14½
K. Glasgow	Test	Plain-Bearings.	Empty	... ...	11	15
L.	,,	,, ,,	Loaded	... ...	15	15
M.	,,	Roller ,,	Empty	... ...	11	15
N.	,,	,, ,,	Loaded	... ...	15	15

Fig. 2.—Tramcar Running Resistance Curves.

percentage greater distance run by the roller-bearing car from the moment the power was switched off at any particular speed, before the speed was reduced to the same value in each case, was 53 per cent. Fig. 2 compares this and similar N.P.L. tests. For log frame saws 95 crank-pin bearings were supplied up to the end of 1923 in Britain, Sweden, and Germany, but the loads on rolling-mill bearings are, perhaps, the most severe in the whole field of engineering. The average pressure intensity with which plain bearings have to deal might be from 1½ to 2 tons per sq. in., and for a number of different types of mills, already fitted and in operation, the various problems outlined above have been satisfactorily solved. Experiments are being carried out with these bearings on sheet rolling mills by Messrs. W. H. A. Robertson and Co., Ltd., in collaboration with the Skefko Ball Bearing Co., Ltd., which are exceedingly promising.

With ordinary bearings the power increased from the beginning to the end of the trial due to heating of the bearings, while with roller-bearings no increase with time occurred. Further trials have indicated an average saving of 43.5 per cent.

Regarding Continental practice, Mr. D. C. Holzweiler, of Wiesdorf-Koln, dealing with the layout of the plant at the Witkowitz ironworks, has described in particular tests on three finishing stands in a mill with six roughing stands and six finishing stands. He shows that one plain bearing required 1.02 kW, and one roller-bearing under the same conditions required 0.325 kW. The tests were no-load tests, and indicated a reduction in power of 69 per cent. on the roller-bearing stands. The tests had not been completed, but it was anticipated that the power saving would be between 30 and 50 per cent. At the time the data were collected, 3,053 tons of rolled material had been produced on the trial train without showing any indication of stress on the bearings. The number of productive revolutions was 9,233,000, and the total number of revolutions 15,182,500; from the latter figures it appears that power saving when running light is almost as important as when actually rolling material.

An impression of the importance of the work which can now be handled by anti-friction units, indicating in a general way that such bearings are not now confined to the realms of general light engineering, is conveyed by the following interesting applications: a rolling mill fly-wheel, weighing 15 tons, and running at 495 r.p.m., this speed being fairly high for a bearing of the size used. The fly-wheel shaft is direct coupled between a 450-h.p. motor and a train of finishing rolls. The fly-wheel also carries a belt, driving a train of roughing rolls. The oil consumed was 17 kilograms per 24 hours, and practically all of the time of three men was absorbed in looking after the bearings. With the roller-bearings, only 0.3 kilogram of oil per 24 hours is used, and the man in charge of the motor attends to this, so that the three greasers are not now required.

A series of electrically-driven rope pulleys, manufactured by Messrs. Mather and Platt, Ltd., the largest so far fitted with spherical roller-bearings, transmits 740 h.p. at 328 r.p.m., with a rope pulley 54 in. in diameter. The calculated load per bearing is about 18,400 lb., which gives a factor of safety of about 4 on the rated capacity of the bearing. The bearing dimensions are 160 millimetres bore by 340 millimetres outside diameter by 114 millimetres wide. A number of large rotary converters in this country, the largest developing 1,000 kW at 750 r.p.m., have been fitted with spherical roller-bearings 160 millimetres bore by 290 millimetres outside diameter by 80 millimetres wide; precautions have to be taken to prevent stray currents passing through the bearings from the rotor to the frame.

The First World Power Conference.

A Review of the Work it Accomplished.

At the annual joint meeting of the Institution of Civil Engineers (Birmingham and District Association), the Institution of Mechanical Engineers (Midland Branch) and the Institution of Electrical Engineers (South-Midland Centre), on February 20th, at Birmingham, Dr. S. Z. de Ferranti in the chair, the subject under discussion was a "Review of the Work of the First World Power Conference." The addresses of the four principal speakers are abstracted below:—

Col. R. E. Crompton, C.B. (speaking for the Institution of Civil Engineers), remarked that the Conference was the first international meeting since the war which showed a laudable endeavour to separate scientific and technical questions of world-wide interest from world politics and in that respect it was a decided step towards world peace. However, he felt it his duty to point out that his experience was that the chief benefit arising from such gatherings was the bringing together of the engineers as well as financial men who were really interested so that they might remain in cordial and close touch with one another, with mutual benefit to themselves and to the future of the work that they were engaged on. The facts and figures thus placed before everybody would well repay careful study, but he felt strongly that these very large international Conferences were somewhat lacking in continuity of thought and endeavour, for even those who took part in them, however expert they might be, were not always sufficiently in possession of facts to give information upon which useful international decisions could be made. It was largely for that reason that the permanent International Electrotechnical Commission was formed. It was useless for any committee of experts to formulate propositions for the industries concerned to adopt unless the constitution of the committee was so representative as to include, in addition to the scientific and engineering sides, also the commercial side. That the I.E.C. process was a somewhat long one was true, but experience had shown that it was the only method by which international agreement could be satisfactorily arrived at. In order to simplify and hasten decisions quite recently a Committee of Action had been appointed, in the nature of a President's Advisory Committee, so that when an Advisory Committee completed a report that was considered urgent and had been accepted by four-fifths of the National Committees in writing, the Committee of Action could issue instructions that it be promulgated at once as an international decision of the I.E.C. without waiting for a plenary meeting, although when a plenary meeting took place the decision of the Committee of Action must be ratified.

Although the central idea of the Power Conference was to show to the rest of the world what the British Empire was doing, the data then collected and papers read showed that in the very important section of water power development the British Empire was far from taking a leading place. So that it now seemed that it would have been better to have confined the papers and discussions to the solving of power and distribution problems common to the whole world, as that must assuredly have led to the whole engineering world working together and producing by loyal team work results of the highest value to everyone. An illustration of that was the International High Tension Conference which met periodically in

Paris. If the World Power Conferences of the future could act as feeders to the I.E.C., in like manner, they would afford valuable assistance to the work of international standardisation.

Some criticism arose at the World Power Conference as to whether the I.E.C. was competent to deal with power from the aspects of steam and gas as well as water, but it must not be forgotten that several years ago the I.E.C. appointed an Advisory Committee on prime movers to be used with electrical plant, and actually in 1914 issued a report on the nomenclature of hydraulic turbines. The I.E.C. had re-constructed and enlarged that Advisory Committee and that report would be considered, revised, and enlarged at a meeting at The Hague in April, 1925.

In respect of the papers read at Wembley, the programme was overloaded to such an extent that no adequate discussion on any one of the interesting matters brought forward could be carried out in a satisfactory manner. If future International World Power Conference National Committees were formed as indicated, it would be their duty to bring forward a few burning questions which affected all countries alike; to invite the views of members on those questions, and to define the discussion at the Conferences, summarising the views thus brought forward. Even then, he doubted whether they would be so valuable to the world as if they had been submitted to small meetings of chosen delegates from each of the National Committees meeting at a central point solely for the one purpose of discussing those questions. At the International Turin Exposition Conference the organisation of the I.E.C. was of great use in directing the discussions that took place into a useful channel.

Colonel Crompton regretted that the cost of distribution was not adequately discussed at Wembley. He had been asked to discuss that problem with the gas industry and possibly with the hydraulic industry. People did not realise that, while gas cost a few pence per 1,000 ft. to make, it cost 3s. 6d. delivered to houses, and the same conditions applied to a large extent in the electrical industry. It was necessary to concentrate upon the economics of the distribution question, especially with the advent of super-station schemes.

Mr. D. A. Bremner, O.B.E. (British Engineers' Association), speaking for the Institution of Mechanical Engineers, also felt that the programme was very much overloaded and hoped that when the next conference was held very careful thought would be devoted to the simplification of the programme.. Consideration of the outstanding features of the papers showed that they were on the eve of some very radical changes. There was going to be a great increase in steam pressures and temperatures, and it looked as though the gas turbine might be successful even during the life-time of the oldest of those present at that meeting.

The low-temperature carbonisation of coal was peculiarly interesting to them, and he particularly wished to emphasise this point. One over-riding consideration in connection with the development of power supply was security; the problem could not be dealt with entirely on technical or even on economic lines. They must take into account the factor of security—even in a military sense—and in this country they should think very carefully before committing themselves too deeply to sources of heat and energy which had to be brought from foreign countries over great distances. While Great Britain contained only 2½ per cent. of the coal resources of the world, it was producing 20 per cent. of the world's production of coal. The Overseas Empire contained 20 per cent. of the coal resources of the world, and its production in 1923 was only about 5 per cent. of the world's output. It was quite evident that they were exhausting their coal resources with a rapidity which should command very careful thought.

With regard to fuel oil, the British Empire produced less than 2 per cent. of the world's output, and of the total quantity imported into Great Britain in 1922 only 4.6 per cent. came from the British Empire. At present they were gambling on the future. No one could predict how long any source of oil supply would last, and they were speculating on factors of which they had no means of ascertaining the quantitative values. Encouraging research work had already been done with peat; admittedly it had a very unsatisfactory early history, but they might in the future also look to derive values from peat deposits.

The general impression received at the Conference was that the non-British element was very strong, both in quality and quantity, and he thought they would have to put their best leg forward if they were going to keep up with the procession. The intensity with which technical research work was being conducted, even in small countries like Sweden and Norway, gave one "furiously to think." In this country, unfortunately, at a time when enterprise was essential, they were all discouraged and weighed down with financial burdens, which hampered their power to give expression to the spirit of enterprise. In this country they were supposed to be a great deal better off than engineers in Germany, but they did not seem to be able to find the money for that kind of purpose. He hoped that question would be the subject of very serious consideration by all concerned. They could not deal with engineering problems on purely technical lines, nor on technical plus economic lines. They had to deal with the human factor, and probably at present it was the most difficult of all the factors in their equation. In this connection it appeared that they should think a good deal before committing themselves to a power-generation policy which would result in a limited number of "pulses," upon which labour could put pressure and stop the circulation of vital necessities. The state of the engineering industry to-day had an important bearing upon the whole question of power supply. In 1924 exports of iron and steel, ships, machinery, and other metal and engineering products were only 79.2 per cent. of the 1913 figures. Imports of the same classes of products were 102 per cent.—two per cent. higher than the 1913 figures. Taking machinery only, exports were 67.3 per cent. of the 1913 figures, and imports were 57.7 per cent. One very important fact was most disturbing; in 1924 the average value per ton of exported machinery was £96.3, while the average value of imported machinery was £175.3. In other words, they were importing very high-class machinery, material raised to its highest value, which was the very class of product that they in this country ought to strive to make for their own requirements, because it was one of the few means of maintaining the people on the plane of living which their people now aspired to.

With regard to finance, he quoted figures for 31 representative engineering and allied firms, having a paid-up capital of nearly 61 millions. In 1923 the average dividend paid was only 4.9 per cent. Even this low rate involved the distribution of an undesirably large proportion of profits, and the consequent starving of reserves, 86.8 per cent. of earned profits having to be distributed to pay the above-mentioned dividend, as compared with only 64.8 of the earned profits in 1913.

Mr. W. B. Woodhouse (President, Institution of Electrical Engineers), said the first World Power Conference was a striking example of the splendid way in which engineering was co-ordinated. It afforded an opportunity of comparing what was done during the war by different nations, and what was being done by way of post-war measures to meet the changed conditions. The disturbance of money values was one of them, and the high price of coal was another. These two factors afforded urgent reasons for considering of the subject of power production. Remarkable developments were made during the war; they were forced to do things that they might not have done if they had looked at them as commercial problems, and they gained much experience in a comparatively short time. The Conference placed those things upon record. The war caused searching inquiry to be made into many problems, and each one seemed to emphasise the problem of power and the necessity of developing natural resources. Every European country was carrying out schemes to reduce its demands for coal; the world demand for coal was not increasing. Before the war, coal output increased annually by 5 per cent. on the previous year over a long period. It seemed that by the reductions we were making in our own coal consumption, and the reductions which other countries were making, the demand for our coal would be reduced; it would only increase by the definite and certain tendency in all civilised countries to use more and more power. In the meantime, the work of the engineers would not perhaps be quite so welcome to the coal industry as to other sections of the country.

It was sometimes said—without real thought—that electricity to-day was going to do for this country what the steam engine did many years ago. People did not remember that in those days they knew all about steam engines, whereas many other countries did not have that information; they were in a favoured position, but to-day any new development in engineering was immediately communicated to every civilised country and all the improvements which electricity might make would be shared equally by the world. Unless they took advantage of those developments, they would lag behind. That seemed to be one lesson of the Conference.

In countries dependent upon coal, there was unanimity as to the line of development—larger power stations using the most efficient generating plant. The Conference last year merely endorsed what Ferranti said in 1888. Electricity must be used as an economical means of transport. He thought there was complete agreement as to the limits of the economical distance of transporting electricity. One paper described a scheme for transmitting power from Norway to Denmark, Norway having a surplus of water power; the amount suggested was 42,000 kW, and the total distance proposed was 475 miles. According to the estimates, it would increase the cost of electricity three times. On top of the generating cost there was the heavy cost of distribution; when the original cost was multiplied by such factors, there must be a limit to transmission.

At the Conference all were agreed as to the need of increased consideration being given to the proper treatment of coal. Everyone agreed, provided it could be made a commercial success, with the proposals for the distillation of coal, which would not only provide fuel for the production of electric power, but oil fuels for which they were now dependent upon other countries. Other countries used more power per man in production than they did, and therefore the value of every man working in a factory was higher because his output was increased by use of the larger amount of power. The importance of the proposals for developments in rural districts could hardly be exaggerated. There was no doubt that the field for discussion at the World Power Conference was too wide, but there was a special reason for that. It would be wiser, in future, to deal with a section of the problem as was done in Paris on the question of transmission.

The Chairman (Dr. S. Z. de Ferranti) said it was a happy circumstance that civil, mechanical and electrical engineers were met together for a joint meeting; it meant a great deal more than one would think at first sight. It was very interesting to notice how the speaker for the Institution of Civil Engineers talked to a very large extent—probably 90 per cent. —electrically. That was a very happy thing; it showed the electrification not only of the country, but of their premier

institution and he would be very glad to see them electrified from every point of view to the fullest possible extent.

The intermixing of views which had taken place about engineering was a very good thing. The lines of demarcation between the various kinds of engineers must of necessity be very much weaker than they had been in the past. Vast works of a civil engineering character were required in almost every case of water power utilisation, and the whole process of carrying out electrical generation and transmission from its source of production and application afterwards, was a mechanical one; electrical engineers were trying all their lives to put electrical things in as mechanical a way as possible.

In the United States the headquarters of the engineering societies were all in one great building in New York City, which was a very great convenience to everyone concerned, and a sign of the times. The more engineers combined and did team work, and the more each individual engineer, whatever his class, knew about the general engineering of other classes, the more would it contribute to progress on the right lines.

At first he was afraid that a World Power Conference might be more bother than it was worth. That was an entirely wrong view, and he recalled with pleasure that in November last he was entertained by representatives of civil, mechanical, electrical, and mining engineers of the United States in New York, the desire being to show the appreciation of American engineers of their British engineering friends whom they had visited at the World Power Conference. They impressed upon him what they thought of the Conference. They said: "You in England conceived a wonderful thing and carried it out in a more wonderful manner. We can teach you nothing in regard to the handling of such affairs."

They had been very much ahead in this country in engineering; they had taught the world a very great deal, but they had now got to look very carefully at their position. They had been reminded by Mr. Woodhouse that other countries had great advantages and were working very hard. This country must use every endeavour to turn its natural advantages to account. For various reasons they had lagged behind—that was to say, they had not been sufficiently in advance of other countries. It did not follow that what was the order at the first World Power Conference would be suitable for every conference of a similar kind. The conception was a great one, and it had to be treated in the broadest possible manner. The effect of bringing together a large number of engineers from all parts of the world, who either at the meetings of the conference, or outside, discussed all sorts of questions, was stimulating to thought and progress, and the results which must follow would be very beneficial to the world at large.

The World Power Conference must have shown how far electricity was the embodiment of power, and how far this power could be used to the advantage of every member of the community. There had been rather more than 5,000 Press notices in this country of the Conference. As engineers, they wanted to get home to the masses of the people; they wanted the whole population to be talking about the matter, selfishly wanting the facilities. The World Power Conference, by reason of its importance in consequence of the fact that people were gathered together from all parts of the world, did, through the medium of the Press, bring it home to a very large proportion of the population of the country. That was, in itself, a most valuable service.

The Electrical Imports of Egypt.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1924 is taken from the recently-issued trade statistics. The figures for 1923 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1923. £E	1924. £E	Inc. or dec. £E
Electrical machinery and parts—			
Total	144,000	147,000	+ 3,000
From Great Britain	26,000	29,000	+ 3,000
,, United States	10,000	13,000	+ 3,000
,, France	48,000	46,000	— 2,000
,, Italy	26,000	13,000	— 13,000
,, Switzerland	13,000	18,000	+ 5,000
Internal combustion engines, stationary—			
Total	255,000	400,000	+ 145,000
From Great Britain	147,000	217,000	+ 70,000
,, France	1,000	4,000	+ 3,000
,, Italy	1,000	12,000	+ 11,000
,, Switzerland	55,000	93,000	+ 38,000
,, Germany	49,000	68,000	+ 19,000
Electric light bulbs—			
Total	44,000	39,000	— 5,000
From Great Britain	1,000	700	— 300
,, Germany	8,000	7,000	— 1,000
,, France	1,000	1,000	—
,, Italy	2,000	700	— 1,300
,, Holland	18,000	19,000	+ 1,000
,, Switzerland	1,000	—	— 1,000
,, Czecho-Slovakia ...	6,000	—	— 6,000
,, Austria	6,000	5,000	— 1,000
Carbon rods for arc lamps—			
Total	1,000	700	— 300
Electric cars and wagons—			
Total	13,000	4,000	— 9,000
From United Kingdom ...	2,000	—	— 2,000
,, United States	—	4,000	+ 4,000
Telegraphic and telephonic apparatus and fittings—			
Total	33,000	49,000	+ 16,000
From Great Britain	25,000	36,000	+ 11,000
,, France	2,000	3,000	+ 1,000
,, Sweden	5,000	8,000	+ 3,000
Meters, electricity, gas and water—			
Total	27,000	25,000	— 2,000
From Great Britain	—	2,000	+ 2,000
,, France	22,000	16,000	— 6,000
,, Germany	4,000	5,000	+ 1,000
Electrical and gas pendants—			
Total	43,000	49,000	+ 6,000
From Great Britain	2,000	1,000	— 1,000
,, France	13,000	20,000	+ 7,000
,, Germany	17,000	17,000	—
,, Italy	7,000	9,000	+ 2,000
Other electrical appliances and batteries—			
Total	51,000	50,000	— 1,000
From Great Britain	11,000	14,000	+ 3,000
,, Austria	2,000	1,000	— 1,000
,, France	6,000	6,000	—
,, Germany	21,000	15,000	— 6,000
,, Italy	7,000	10,000	+ 3,000
,, Switzerland	1,000	1,000	—
,, United States	2,000	2,000	—
Electric cables, insulated—			
Total	68,000	96,000	+ 28,000
From Great Britain	12,000	14,000	+ 2,000
,, Belgium	5,000	9,000	+ 4,000
,, France	29,000	36,000	+ 7,000
,, Germany	13,000	15,000	+ 2,000
,, Italy	4,000	14,000	+ 10,000
,, United States	1,000	1,000	—
Uninsulated electric copper wire—			
Total	20,000	23,000	+ 3,000
From Great Britain	7,000	—	— 7,000
,, France	10,000	14,000	+ 4,000
,, Germany	1,000	6,000	+ 5,000
,, United States	2,000	—	— 2,000
Electric light fittings—			
Total	70,000	66,000	— 4,000
From Great Britain	9,000	6,000	— 3,000
,, Belgium	1,000	2,000	+ 1,000
,, France	14,000	14,000	—
,, Germany	29,000	28,000	— 1,000
,, Italy	5,000	5,000	—
,, Switzerland	4,000	5,000	+ 1,000
,, United States	3,000	2,000	— 1,000

£E = £1 0s. 6½d.

The United States and Canadian Power.—The *Electrical News*, of Toronto, voices the views of a large number of people who are seriously alarmed at a report that the Dominion Government is favourably considering the development of a large power site near Montreal, for the production of electricity for export to the United States. It is considered that any such scheme would be of a permanent nature, and any future endeavour to cease supplying the power would lead to grave international complications. Moreover, Canada needs her power, although it may seem that there is no present outlet for it. As fast as new sets are installed at Queenston the power is "snapped up," and the St. Maurice Power Co.'s offer of 150,000 h.p. was absorbed in a few weeks. At Nipigon two years ago, it appeared doubtful whether the output of one set would be absorbed, but the station now has four sets and there is no thought of any surplus. The same condition holds good throughout the Dominion. Our contemporary comes to the conclusion that Canada needs all the power which she can produce.

The Toronto correspondent of *The Times* reports that Mr. Beatty, president of the Canadian Pacific Railway, opposes the scheme on the ground that the export of power would obviously lead to the establishment of industries in a foreign country, and the loss of occupation by Canadian workmen. It is thought that the Ontario and Quebec Governments will unite against any attempt by the Dominion Government to give power rights in the St. Lawrence to private companies or to sanction the export of power. Unless the demands of these provinces are recognised by the Federal Government, the conflict between Ontario and the Dominion may become as acute as was that over the boundaries of the province 40 years ago.

Economic Conditions in Belgium.

Mr. J. Picton Bagge, Commercial Secretary to the British Embassy in Brussels, has forwarded to the Department of Overseas Trade a report on the financial and economic conditions in Belgium,* dated December, 1924.

In his introductory remarks, Mr. Bagge says that the most salient feature of industrial life in Belgium to-day is the movement towards the reduction of costs of production. Overhead charges are being reduced by an increase in the output capacity, mechanical labour-saving machinery is being installed on all sides, workshops are being planned to allow of the greatest economy in working and are being equipped with the most modern machines. Economy of fuel is also receiving serious attention, as is also the centralisation and distribution of electric power.

In the domain of public finance, the burden of reconstruction is growing lighter and within a year or two no more capital expenditure will be required. Belgium has now placed her finances on a sound business footing and has made them self-supporting and completely independent of the payment of the vast sums due from Germany. In the economic field, the trade balance can be regarded as not so unfavourable as it was in pre-war years.

The Metallurgical and Engineering Industries.

The year opened under fairly favourable auspices for the metallurgical and engineering industries. Orders were plentiful and remunerative, the transport system was improved, and coke prices had fallen. The depreciation of the franc brought in many more foreign orders, but the measures taken to arrest the decline brought about a violent reaction which lasted until October. A better tendency then prevailed, orders became more numerous and prices hardened, although towards the end of the year there was a falling off. The closing weeks of the year were clouded by the prospect of a general lock-out in the metallurgical and construcuonal engineering industries, but a spirit of compromise prevailed and a settlement was reached.

In the electrical engineering branch work was plentiful. The development of electrical power throughout the country has greatly increased the demand of the home market, and export trade has also been good. A shortage of skilled hands is reported.

Electrical Development.

The use of electricity for lighting and power purposes continues to develop by leaps and bounds. The reports of the various power companies operating throughout the country afford abundant proof of this development. The number of consumers, especially of power, has grown to such an extent that power stations are constantly having to be enlarged or constructed. This development is not confined to industrial areas, but is general in the country districts where electrical power is being applied to all branches of farming, and to home industries. The extensions undertaken by the various companies have called for many increases of capital during the past year, amounting in all to over 100 million francs. A list of the principal extensions during the year is given in the report; the largest was that of the Société Intercommunale Belge de l'Electricité—from 79,250 kW to 107,400 kW. The list shows that the growth is not only considerable, but also general to all parts of the country. Production is becoming more and more centralised in large power stations. In 1923 there were 12 stations of over 15,000-kW capacity with a total rating of 263,000 kW. In 1924 the number had grown to 16 and the capacity to 394,900 kW. In addition to the stations of the electricity supply companies, there are those belonging to the important metallurgical works, which have been combined for the reciprocal supply of power and for furnishing the adjoining districts. For instance, the Union des Centrales Electriques, formed by the great works in the Liége district, has been connected with the Liége municipal power station, and that of the Société d'Electricité du Pays de Liége. Another amalgamation of the same kind which took place last year was that of two large metallurgical works in the province of Hainault. These have further connected their systems with that of the Société d'Electricité d'Hainaut. In the province of Luxemburg a scheme is under consideration by which three existing companies, with the co-operation of the provincial Government, will construct 316 km. of new lines, and supply current to over half of the population of the province. In the province of Antwerp, the installation in the northern districts is making rapid progress, and is expected shortly to be completed. In the province of Limburg, where the great Campine coalfield lies, a system of 500 km. of high-pressure lines is under construction, and should be completed in 1927. At the present time about 170 km. has been completed and is in use. A further 100 km. is under construction, and tenders have been invited for another 127 km. The province, which is divided into five zones, is limiting its action to constructing and exploiting a high-pressure system. The communes construct and exploit low-pressure systems, taking delivery at transforming stations. With few exceptions all communes are studying plans for the construction of low-pressure systems.

In the Cantons of Eupen and Malmédy an important scheme now under consideration for furnishing electric light and power is approaching realisation. A barrage is to be constructed in the valley of the Warche at Béverée, near Malmédy. The cost of this work, which will be of ferro-concrete, is estimated at 15 million francs. It will have a height of 40 metres, and the lake formed will cover eight square km. The central station, which will be on the barrage, is to have a power of 3/4,000 kW. There will probably be 160 km. of high-pressure cables (15,000 V) and 30 or 40 transforming stations.

In addition to the development of the use of electricity for lighting and industrial power purposes, there is also to be noted the growing electrification of the light railways.

Telegraphy and Telephony.

No new telegraph routes were installed during the year, nor is it proposed to install any in 1925. At October 1st, 1924, the total length of lines forming the system was 46,187 km. It is hoped to begin the laying of the international cable between La Panne and Herbesthal before next June and to have it ready for operation by the end of next year.

Work on the radio-telegraph station at Ruysselede, which was begun in 1923, has been actively pushed forward, and it is anticipated that the work will be completed before the end of 1925.

As regards telephony, it is reported that a further automatic exchange was opened at Brussels in December last, and it is expected that two more exchanges will be converted within the next eighteen months. An automatic exchange was opened at Antwerp in December. No important automatic exchanges will be opened during 1925, although a number of rural stations are expected to be completed. The central exchanges at Liége, Seraing, Herstal, and Chênée will be converted during the next three or four years, while the work of constructing automatic exchanges at Antwerp (south), Berchem, and Borgerhout will be spread over six years. The total credit provided in the 1925 Budget for improvements of the telephone system is 225.7 million francs.

The only broadcasting station in Belgium is that at Brussels. This has a 1-kW transmitter operating on a wave-length of 265 metres. Its expenses are partially defrayed by charges, levied at so much per valve, upon receiving sets. The establishment of stations at Liége and Antwerp is being discussed. It is stated that over 50,000 people possess receiving installations, and there is every prospect of a rapid and extensive development. Two years ago there were only five companies in Belgium supplying radio apparatus; there are now at least a hundred. All necessary apparatus can be produced in Belgium, and in January, 1924, the Groupement Belges des Constructeurs et Vendeurs de T.S.F. was formed to co-ordinate the activities and promote the interests of all firms in Belgium connected with the radio industry.

General.

In December last a national committee was set up by Royal Decree for the purpose of investigating all means for the development of national production. The committee comprises leading men in the banking, industrial, and commercial world, as well as representatives of trade unions and Government departments. The Minister of Labour and Defence defined the task of the Committee as the investigation of the field of industrial collective action, both by groups and by industry as a whole, and to lay down a definite industrial policy. Further points to be considered were imported labour, technical and professional instruction, transport facilities, the commercial policy in view of treaties of commerce, the advantages derived from exhibitions and fairs, the institution of a central information office, the development of the national mineral resources, and credit. The Committee is divided into three sections, dealing, respectively, with industry, export, and credit.

A number of exhibitions and fairs were held during the year, the principal one being the fifth Brussels Commercial Fair held in April. The fair continues to progress; the number of British exhibitors was 95, this country holding the second place in the list of foreign countries represented. Coincident with the Brussels Fair, the sixth International Rubber Exhibition was held, and British exhibitors were again well represented. A Radio Apparatus Exhibition was held in September last. An International Exhibition of Electricity was to have been held during the current year, but it has been found necessary to postpone it until 1930. In the same year the centenary of Belgian independence will be celebrated by a Universal Exhibition at Brussels and Antwerp.

Unemployment continues to be practically non-existent in Belgium, and in no month of 1924 did it exceed 3.8 per cent. There is still a shortage of labour in the mining and agricultural industries, and, as mentioned above, in the electrical and constructional engineering and metallurgical industries. The system of family allowances continued to expand during the year under review and the movement now embraces firms employing 280,000 workmen, of whom 160,000 belong to the mining industry. Efforts to make the system compulsory have, however, encountered strong opposition.

An appendix to the report dealing with the situation of the Grand Duchy of Luxembourg states that the Bill empowering the Government to grant a concession for the electrification of that State was passed into law in February, 1924. Tenders for the concession were invited and a number of offers are now under consideration.

* Stationery Office. 3s. 6d. net.

The "Aeroflex" and "Zenal" Fusible Cut-outs.

Parmiter, Hope & Sugden Patent Fuses.

We recently paid a visit to the "Fluvent" works, and witnessed an extremely interesting demonstration of the behaviour of some of Messrs. Parmiter, Hope & Sugden's products in operation. The company has studied the process

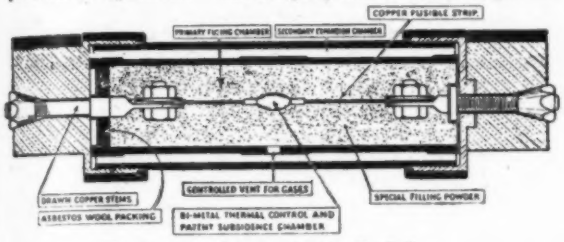


Fig. 1.—Cross Section of "Aeroflex" Fuse.

of rupturing a circuit by fusion for a period of 20 years, and has discovered some remarkable facts in connection with fusible cut-outs, which have not yet been published.

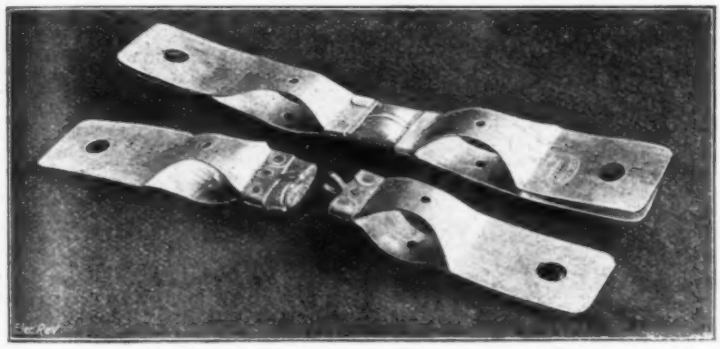


Fig. 2.—"Aeroflex" Fusible Elements, Intact and Blown.

The most notable of these is that in the case of enclosed fuses the explosion that usually takes place on breaking a circuit occurs, not at the arc or even inside the enclosure, but at the places where the hot gases set free by the arc come into contact with the surrounding air. This appears to be a fact of fundamental importance, having a direct bearing on the design of fuses, and has led to the evolution of the "Aeroflex" fuse, of which we give some particulars below.

The "Aeroflex" fuse consists of two cylindrical casings of different sizes, arranged one inside the other so as to form two chambers, the inner chamber being the interior of the inner casing and the outer chamber being the space between

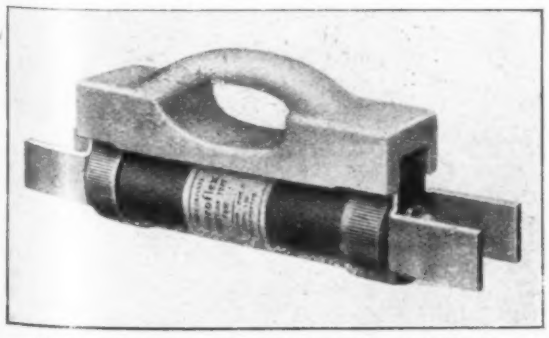


Fig. 3.—"Aeroflex" Carrier with Shielded Porcelain Handle.

the two casings. The inner chamber and casing is similar to the ordinary cartridge fuse; the fusible element is arranged down the centre and surrounded with special filling powder. Communication between the inner and outer chambers is provided by means of a small opening in the inner casing normally closed by means of a paper seal.

When the fuse is blown under heavy short-circuit conditions, the gases and a quantity of the powder pass from the inner into the outer chamber through the small opening. There is no vent in the outer chamber, which contains very little oxygen; the gases simply cool down, and no explosion takes place. The general construction of the "Aeroflex" fuse is shown in fig. 1, and it will be noticed that the fuse contact terminals are embedded in the filling powder in the inner chamber.

The fusible element, the "Aeroflex" patented bi-metal fuse strip, consists of a tinned-copper strip in the centre of which is inserted a hollow pocket of pure tin filled with inert gas. This pocket forms a subsidence chamber into which the molten metal formed by the melting of the pocket collects. This construction entirely prevents the holding up of the "scale" at melting, which often happens in the ordinary cartridge fuse, and in consequence eliminates all possibility of the fuse "holding up" due to the "scale effect." The melting of the tin pocket takes place under ordinary overload conditions, and the control of the overload capacity is effected by temperature control holes drilled in the strip at each side of and near the pocket.

Two points at which the fuse can rupture under short-circuit conditions are provided at the narrow sections, and these points are made definite by the insertion of short-circuit slots at the narrowest parts.

Fig. 2 shows two fusible elements, one intact and one blown under overload conditions, and it will be noticed that the half of the pocket remaining is filled with tin which has run down from the top half of the pocket which has melted.* The thin band covering the tin pocket is a reduced portion of the copper strip. It will be appreciated that the fuse can only be effectively used in a vertical position because of the pocket formation under overload conditions.

The fuses are rated by experimentally ascertaining the maximum current that one will carry with the attainment of a definite final temperature (and therefore resistance). Millivoltmeter tests are made for the pressure drop across the strip, and if the loading is such that after a suitable period the millivoltmeter shows even the slowest rise, it is certain that the fuse will eventually blow with that load. By this means the fuses can be rated to a very close degree of accuracy, and they can be relied on to remain as originally rated.

Great care has to be taken to ensure that the whole of the copper strip purchased for use in fuses is of the right quality, as

Fig. 4.—"Zenal" Element showing Tin Melting under Load.

Fig. 5.—"Zenal" Element at Moment of Final Rupture.

* The elements were not photographed, and hence are not illustrated, in the correct vertical position.

remarkably wide variations in conductivity have been met with. The powder filling surrounding the strip is thoroughly shaken down so as to leave no air holes. The paper seals ("pressure-release labels") referred to for sealing the inner chamber are of necessity uniform in texture and thickness; they are supplied, together with a special cement, with the fuses in little packets.

After a fuse has blown, the residue of the strip, by virtue of the point at which it is ruptured, clearly indicates the nature of the load under which it blew—whether a heavy short or an ordinary overloading of its capacity.

The effectiveness of the "Aeroflex" fuse is emphasised by the fact that many makers of fuses are having their fittings equipped with these non-explosive fuses. They are made in sizes up to 600 A at 650 V, and in another type up to 2,000 A at 460 V, and can be supplied with or without porcelain bridge-carrying handles. Fig. 3 shows a fuse carrier of the shielded handle pattern. To renew the element in the cartridge is quite a simple matter; the contact terminals are adjusted by means of the thread and nut which will be seen in fig. 1, held by the cap which is screwed on to the outer casing, and holds the inner casing in position.

Messrs. Parmiter, Hope & Sugden are also makers of another patent fuse element, the "Zenal." This is a non-enclosed design, and can be used in any contacts of suitable size. It consists of a copper strip somewhat similar in design to the "Aeroflex," but the ordinary overload rupturing part consists of a soft tin slab sweated to and covering the centre portion of the strip in such a way that it carries the bulk of the current. The centre part of the copper strip is reduced to two very thin strips, one on either edge, forming a hole in the strip over which the tin slab is placed. When overload is applied the tin first melts away at a rate depending on the amount of overload, until finally it entirely disappears, leaving the two thin strips to carry the load; these, of course, soon blow. The "heavy short" points and the capacity adjustments are exactly the same as in the "Aeroflex" fuse.

Fig. 4 shows a "Zenal" element "under load" and the tin melting and running down in a blister. Fig. 5 shows the element after the tin has fallen off, one thin strip has parted, and the circuit is being broken at the other as indicated by the arc.

Most exhaustive tests on all designs of fuses are carried out in the P.H.S. laboratory, voluminous records of which are to be found there.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

Improved "Clix" Connectors.

The "Clix" connectors made by Autoveyors, Ltd., have recently been improved in appearance, and, it is claimed, in efficiency, by being given a nickel coating. The original "Clix" was, of course, both a plug and a socket; now the firm has produced a separate socket on similar lines, which, like the plug, is provided with lock nuts.

A Resistance-Capacity Coupling Unit.

Those who appreciate the difficulty of designing l.f. iron-core transformers to behave properly over the large frequency range utilised for broadcasting purposes, and have accordingly attempted to eliminate any iron-core inductively-wound device from the receiver in order to assist distortionless reproduction, will be interested in the "Polar" resistance-capacity coupling unit which has been placed on the market as a substitute for iron-core l.f. transformers.

Fig. 1 is a simple graph showing the performance of typical transformers of the best makes based on tests with a cathode-

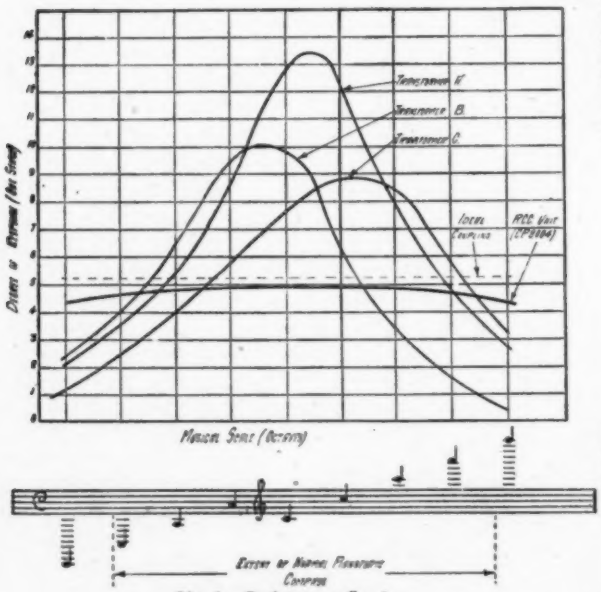


Fig. 1.—Performance Graph.

ray oscillograph at the R.C.C. laboratories. The base line covers the frequencies obtainable on the full scale of a piano; the vertical axis represents the degree of response. It will be seen that the performance of all the transformers varies considerably with the pitch, or frequency, of the signal and, further, that no two transformers are alike. Distortionless amplification would be represented by a line running absolutely parallel with the base line (such as the dotted line in the figure), the height above the base line representing the degree of response. The graph, in addition, also shows the performance of a Polar resistance-capacity coupling unit, which demonstrates, first, an entire lack of distortion over the whole piano range of frequencies; secondly, it shows that a transformer gives greater overall amplification than does the resistance unit. Therefore, a listener whose greatest need is volume would be well advised to use transformers, because two stages of transformer l.f. amplification is equal approximately to three stages of l.f. amplification by means of "Polar" resistance units, but those whose object is to hear without strain what is being said, and to enjoy in comfort good music, will willingly sacrifice some of the unwanted volume which offends the ear, or add a valve to strengthen the signal. The Radio Communication Co., Ltd., is fitting all its new model receivers with these units in place of transformers, and is also marketing them separately to enable home set builders and those who have already purchased sets to make use of them.

The anode resistance is wire-wound, with small self-inductance and small self-capacity. The voltage drop between adjacent turns is small, hence there is no fear of breakdown, and even on high-voltage circuits the temperature rise is small. The moulded bobbin is fitted with a waterproof cover to protect the winding, and the coupling condenser is of a new type manufactured by the Dubilier Co. The grid leak forming part of the unit is of Mullard type and is housed inside the anode-resistance bobbin; it is held in position by a phosphor-bronze spring at its lower end, and by a self-locking catch at the upper end. The leak can be replaced if necessary without interfering with the connections of the unit.

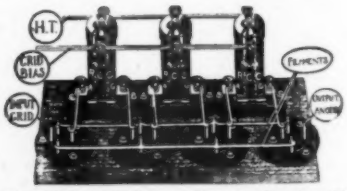


Fig. 2.—"Polar" Resistance-Capacity Coupling Units.

The terminals of the unit are carefully arranged so that amplifiers may be built up from such units without trouble, fig. 2, and straight bus-bar connections may be employed for the h.p. positive and grid bias. The unit takes up very little room, its overall measurements being 2¾ in. by 1 in. at the base, and 3¼ in. high.

"Leakfree" Ebonite Panels.

Messrs. Fuller's United Electric Works, Ltd., have sent us particulars and a sample of their new "Leakfree" red-line ebonite panels. The material is "three ply," consisting of a sheet of red ebonite between two layers of black ebonite, treated to form a solid, practically inseparable sheet. The material has an excellent velvet matt surface and the panels are cut exactly to the specified size with absolutely square edges. The panels are made in five standard sizes ranging from 6 in. square to 18 in. by 9 in., and in two thicknesses, 3/16 in. and ¼ in. Tests made on the sample panel proved it to be easy to drill or cut, and remarkably free from leakage. The material compares very favourably with samples of "unnamed" ebonite.

A Marconiphone Series-Parallel Variometer.

The Marconiphone Co., Ltd., has recently placed upon the market an efficient variometer, as illustrated in fig. 3. In the design of this instrument a departure has been made from the usual type, in that it comprises an exceptionally neat system of automatic switching for connecting the rotor and stator in series or in parallel without any external switching. This is effected by means of wiping contacts,

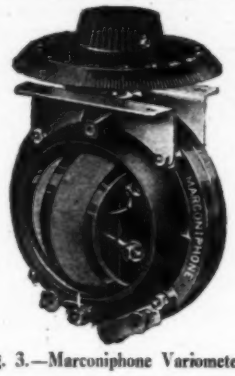


Fig. 3.—Marconiphone Variometer.

which enable an unusual range of wavelengths to be covered by one revolution of the dial, which is engraved from 0 to 360 deg. This variometer is smooth in action, strong, and well finished, and provision has been made for panel mounting by means of two angle plates fitted to the variometer. The wave range, when used with a standard 100-ft. Post Office aerial without any additional condenser, is 230—1,630 metres. The maximum wave range, when used with a standard 100-ft. Post Office aerial with an additional condenser of 0.001 mfd. in parallel, is 3,380 metres.

A New Earthing Clip.

A new earthing clip, WL.241, on which a patent is pending, has been produced by the Edison Swan Electric Co., Ltd. It is made of soft tinned copper strip, being 5 in. long, and perforated with 5/16-in. diameter holes spaced at ½-in. centres. A substantial terminal screw exerts a pull on the strip when it is passed round a water pipe and draws together the strip and

Fig. 4.—New Ediswan Earthing Clip.

earthing wire, which is inserted between the strip and the pipe. The clip, fig. 4, which sells at a low price, can be fitted in a few seconds, and a very efficient earth connection is thereby obtainable. It is manufactured entirely at the Ponders End works, and is not only specially applicable to radio work, but will also be found very useful for general installation purposes.

Parliamentary.

[By Our Special Parliamentary Reporter.]

London Electricity Supply Bills.—As we have already reported, the preamble of the No. 2 Bill has been passed by the House of Commons Committee, and that of the No. 1 Bill was considered on March 26th and 31st and also passed.

In opening the case for the promoters on March 26th, Mr. Tyldesley Jones, K.C., said that the companies concerned had arrived at a similar agreement with the London County Council as that concluded between the Council and the promoters of the No. 2 Bill. There were only clause matters to be considered.

Resuming on March 31st, Counsel said that he understood that Sir Lynden Macassey, K.C., who represented the Boroughs of East and West Ham, had no objection to the Committee's formally declaring the preamble of the Bill proved, but wished to submit clauses for the protection of these boroughs. A clause for the protection of the Poplar Borough Council had been agreed between the Council and the promoters of No. 2 Bill, and he was prepared to accept that clause so far as Poplar was concerned in the present Bill. Therefore there would be no opposition to the preamble of the Bill.

There was opposition on clause matters by the London, Midland & Scottish and the London & North-Eastern Railway Companies, and counsel asked that, as the points to be raised also affected the North Metropolitan Co.'s Bill (which was to be considered next by the Committee), they should be discussed after the hearing of that Bill. The Committee decided to approve the preamble of the Bill.

The City of London Corporation put forward certain amendments to the agreement between the London County Council and the promoters of the two Bills with the object of safeguarding the interests of the consumers under the sliding scale. It was asked that provision should be made, making it incumbent upon the companies, in their published accounts, to include a table showing the proportions of total revenue derived from the four classes of consumers under the sliding scale. The reply of the promoters of the Bills was that this matter was in the hands of the Electricity Commissioners, who had power to require the companies to publish what they considered necessary.

The Committee considered that some clause ought to be included, and suggested that the London companies should include in their statements to the Electricity Commissioners the particulars suggested by the City Corporation, and the promoters agreed to do this.

Another amendment desired by the City Corporation was to the effect that inquiries held by the Electricity Commissioners with regard to price revision should be public, but the Committee was opposed to this.

Later, the chairman intimated, in connection with another suggested amendment, that the Committee was not prepared to discuss any alteration in the sliding scale.

Mr. Tyldesley Jones, K.C., then informed the Committee that the next Bill, the North Metropolitan Electric Power Co.'s Bill, was unopposed, with the exception of a point on clauses raised by the railway companies on the Bill and also in the No. 1 Bill, as already mentioned. It was agreed to deal with the point at once and to apply the decision to all three Bills.

Mr. Tyldesley Jones, K.C., said that the North Metropolitan Bill proposed, at the request of the Hertfordshire County Council, to bring within the area of supply the remainder of the county of Hertford not now served by the company, to increase the capital by £500,000 with one-half borrowing powers, and to extend the Brimsdown power station.

Sir James Devonshire, chairman of the company, then formally proved the preamble of the Bill. He said that the company spent £350,000 last year on capital account, and the programme for the present year was for about the same amount.

Consideration was then given to the clause point raised by the L. & N.E. and the L.M. & S. Railway Companies against the two Bills. The point in question was the prevention of the electricity supply companies from laying electric lines across or alongside railways under Section 20 of the Electric Lighting Act of 1919, subject to consent of the Ministry of Transport, or a decision given by the Railway and Canal Commissioners to whom the Ministry can refer any such matter.

Mr. Tyldesley Jones, K.C., said that Section 20 had been framed after the railway companies had been heard fully; he asked the Committee not to make any alteration in the code. There was also provision for going to arbitration to determine questions affecting compensation. So far as possible damage was concerned and for which there was protection in the Act of 1919, this only related to telegraphs, telephones and signals, but he understood that the railway companies were asking that the protection should also apply to the mains and cables which they might lay for working the lines electrically. Thus a railway company could electrify its lines to-morrow and say that an electricity supply company in the neighbourhood was interfering and must alter its system.

The Hon. Evan Charteris, K.C., said the railway companies regarded this as a very serious matter as affecting the working of their railways and therefore the safety of the public. The railway companies were tied down to the line of railway, and it was fair to ask that other people working electric lines in the neighbourhood should take reasonable precautions to prevent interference from leakage of electricity, which might have serious effects upon the working of the railway. The promoters of the No. 2 Bill had given the railway companies what they asked for.

The Chairman said the Committee thought that the request was very reasonable.

Mr. Richards, electrical engineer to the L. & N.E. Railway Company, gave evidence in support of the case for the railway companies. He said that there was a risk of interference, through leakage from electricity supply mains, with the remote control from the power house. Again, there might be a danger of the current being taken off a line by some outside agency and that would be a serious matter.

Mr. Tyldesley Jones, cross-examining, suggested that electric railways had been worked in the North-East Coast district for 22 years under the present legislation without any trouble whatever.

Witness said that the control cables for feeding the line were liable to be affected by inductive interference by some other cable not on railway property. He agreed that there were no provisions for making the railway companies take precautions against interfering with supply cables. He admitted that the electric lines of the Southern Railway had been worked with complete satisfaction for 15 years under the existing legislation. Re-examined, witness said the real trouble was anticipated with the remote control on electric railway systems.

In answer to the Chairman,

Mr. Tyldesley Jones, K.C., said that under the clause, the railway company could put down a cable parallel with an existing supply cable, and then compel the supply authority to remove its cable.

The Hon. Evan Charteris, K.C., for the railway companies, said all that was required was that reasonable precautions should be taken by the supply authority and in the case of dispute an arbitrator would decide.

Mr. C. H. Merz said that there was not the slightest difficulty in laying remote control systems on railways. They had been used extensively in America, Australia and South Africa. The protection for the railway companies was unnecessary so long as the railway companies' systems were properly constructed.

Mr. W. B. Woodhouse, President of the Institution of Electrical Engineers, and chief engineer of the Yorkshire Electric Power Company, said there had only been one complaint of interference with a signalling system, and when the railway company concerned brought the signalling system up-to-date, the trouble disappeared. The proposed clause was one-sided and if the railway companies took the necessary precautions there should be no trouble under the existing legislation.

During the course of the discussion, it was stated that originally the railway companies' clause was inserted in the North Metropolitan Power Bill but it was withdrawn, with the assent of the railway companies, because the supply companies had drawn their attention to the far-reaching nature of the clause.

The Committee then adjourned.

On the resumption of the proceedings on April 1st, the Chairman said that the Committee was prepared to see that the necessary protection was granted whenever the works of the supply company were on railway property but it was not inclined to give any protection otherwise. On the other hand, it did not want to put in anything that would in any way look as if the railway companies had not got the necessary protection at law.

The Hon. Evan-Charteris, K.C., addressing the Committee on behalf of the railway companies, said that the question was simply as to whether the companies supplying electricity were to come under a legal obligation to take all reasonable precautions so as not injuriously to affect the lines of the railway companies in working their undertakings. Electrification of railways was contemplated or being carried out, and for the purposes of electric traction on railways, the remote control system was to be employed. Any sort of interference by electrical disturbance meant that at a given moment the transmission of electricity to the operating lines of the railway might be rendered impossible, or *vice versa*, it might be impossible to cut off transmission. The railway companies asked that the protection given them by Parliament under Section 20 of the Electric Lighting (Clauses) Act, 1899, with regard to their signalling apparatus should be made to apply to other apparatus used for traction.

A clause was finally arrived at applying the provisions of Section 20 of the 1899 Act for the protection of all the railway companies' wires and lines in cases where the supply companies apparatus laid under the provisions of the Bill was on the property of the railway companies. This clause was inserted in both the Electricity Supply (No. 1) Bill and the North Metropolitan Electric Power Supply Company's Bill.

Trunk Telephone Wires.—On March 31st, Sir Wm. Mitchell-Thomson, replying to Mr. Sandeman, said that of the total mileage of wire in use for trunk telephone purposes on December 31st last, 47.9 per cent. consisted of underground conductors. As to cost, figures for trunk wires, as distinguished from other wires, were not available. The cost of upkeep varied with the gauge of wire, the number of wires on the pole route or cable, and other factors. Broadly speaking, it might be said that where many wires followed a given route, underground wires involved lower costs of upkeep per circuit than overhead wires.

Horley District Gas Co. (Electricity Supply) Bill.—This Bill was read a third time in the House of Lords and passed on April 1st.

Barrow Corporation Bill.—This Bill, which proposes, among other things, to confer on the Corporation powers to convert the tramways to the railless system and to run motor-'bus services outside the borough, has been approved by the Local Legislation Committee of the House of Commons.

X-ray Apparatus.—On April 2nd, Dr. Little asked the President of the Board of Trade whether he was aware of the effect of the Safeguarding of Industries Act on X-ray workers in this country; that, in some cases, the actual tax which the consumer had to pay, owing to various accessory charges, might be as high as 60 per cent.; and whether, seeing that this made it difficult for medical men practising X-ray treatment to have the best modern apparatus, he would consider the advisability of removing from the schedule at any rate those types of apparatus which were not manufactured in this country by British firms.

Sir B. Chadwick, Parliamentary Secretary to the Board of Trade, said he was unable to conceive how the actual tax paid under the Safeguarding of Industries Act could possibly be at the rate suggested. He was aware that certain special types of X-ray apparatus were not at present produced in this country, but, having regard to the purpose of the Act in question, he was not prepared to introduce the legislation necessary to give effect to the hon. member's suggestion.

Electricity Companies' Reserves. — On April 2nd, Mr. Gillett asked the Minister of Transport what was the amount of money in the existing reserves of the London electricity companies that could be capitalised under the terms of the Bills now before Parliament.

Colonel Ashley said that the statistical basis on which the amount was to be calculated was to be prepared by the companies and agreed with the Joint Electricity Authority, subject to an appeal to the Electricity Commissioners, within six months of the establishment of the Joint Authority under the London and Home Counties Electricity District Order; this was now before him for confirmation. The amount could not, therefore, yet be stated.

L.C.C. Tramway Scheme Rejected.—On April 1st, a Select Committee of the House of Lords declined to allow the Bill promoted by the London County Council, to enable it to construct new tramways, to proceed. The scheme was for a new route from Catford to Eltham, but it was described as "premature."

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

12,766. "Telephone receivers." Western Electric Co., Ltd. (Western Electric Co. Inc.). May 12th, 1923. (Convention date not granted.) (207,148.)

23,304. "Wireless signalling apparatus." D. S. B. Shannon. September 18th, 1923. (Cognate application 23,762/23.)) (230,510.)

28,635. "Circuit arrangements for automatic selectors used in telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. November 13th, 1923. (230,521.)

28,642. "Inductance or coil holders for wireless purposes." Abbey Industries, Ltd., H. Melville-Smith, and S. J. Tyrrell. November 13th, 1923. (230,522.)

29,551. "Electric switches." J. B. Tucker. August 18th, 1924. (230,527.)

31,031. "Apparatus for use in disinfecting telephone mouthpieces." P. S. O'Donnell. December 10th, 1923. (230,534.)

31,087. "Lighting device for sewing machines." W. Fairweather (Singer Manufacturing Co.). December 11th, 1923. (230,537.)

31,106. "Electric relays." A. Reyrolle & Co., Ltd., and J. Piquet. December 11th, 1923. (230,538.)

31,165. "Electric lamps for use as inspection lamps on motor vehicles and for like purposes." S. Wiseman and A. G. Westmoreland. December 11th, 1923. (230,543.)

31,224. "Electric junction boxes and means for bonding metal-covered cables thereto." F. C. Raphael and W. T. Glover & Co., Ltd. December 12th, 1923. (230,544.)

31,260. "Automatic or semi-automatic telephone systems and apparatus for use therewith." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. December 12th, 1923. (230,547.)

31,326. "Electric plug-and-socket connections." A. Reyrolle & Co., Ltd., and H. F. Secretan. December 13th, 1923. (230,549.)

31,486. "Telephone receivers and like instruments." E. V. Macintosh. December 15th, 1923. (230,552.)

31,490. "Electric connectors for the terminals of telephone and like flexible leads." D. R. Poyser and E. A. Poyser. December 15th, 1923. (230,553.)

31,623. "Electric relays." A. Reyrolle & Co., Ltd., and J. Mirrey. December 17th, 1923. (230,557.)

31,667. "Electric transformers." P. W. Willans and M. Ward. December 17th, 1923. (Cognate application 11,338/24.) (230,559.)

31,943. "Telephone-testing systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). December 20th, 1923. (230,563.)

32,028. "Electrical switches." F. B. Cox. December 21st, 1923. (230,566.)

32,280. "Electric motors for use on a constant-current variable-voltage system." G. Austin, J. C. Macfarlane, and W. A. Macfarlane. December 27th, 1923. (230,572.)

32,442. "Telephone exchange systems." Western Electric Co., Ltd. (A. Capek and F. van den Broeck). December 28th, 1923. (Addition to 228,593.) (230,573.)

32,498. "Starting apparatus for electric motors." S. Gowen and Metropolitan-Vickers Electrical Co., Ltd. December 29th, 1923. (230,575.)

32,501. "System of transmitting views by means of telegraphy or wireless telegraphy." J. L. Baird and W. E. L. Day. December 29th, 1923. (230,576.)

1924.

469. "Retractive switch or electric signalling key." General Electric Co., Ltd., and A. H. Spinks. January 7th, 1924. (230,578.)

1,863. "Apparatus for measuring electric currents." Sachsenwerk Licht- und Kraft Akt. Ges. and J. Fritz. January 13rd, 1924. (230,592.)

1,946. "Telephone tag or hook for connecting wires." W. H. Turton, Junr. January 24th, 1924. (230,593.)

3,524. "Miners' safety lamps." J. Riley. February 11th, 1924. (230,604.)

4,692. "Motor vehicle lighting arrangements." E. A. Jeannotte. February 23rd, 1924. (230,613.)

5,203. "Variable electric condensers." F. G. Warbrook. February 29th, 1924. (230,615.)

5,522. "Miners' and like safety lamps." T. Haywood and S. L. Haywood. March 4th, 1924. (230,618.)

6,103. "Asynchronous motors." E. Henry. March 12th, 1923. (212,910.)

7,473. "Diaphragm for sound reproduction." F. A. E. Jenkins. March 24th, 1924. (230,634.)

7,696. "Variable inductance coils and circuits for wireless reception." J. J. Rathbone. March 26th, 1924. (230,638.)

8,288. "Arc discharge tubes." Naamlooze Vennootschap Philips Gloeilampenfabrieken. January 10th, 1924. (227,407.)

9,113. "Power transmission device for motor-driven sewing machines." Singer Manufacturing Co., Ltd., and H. Corrall. April 10th, 1924. (230,632.)

9,987. "Hydrometers." Chloride Electrical Storage Co., Ltd., and H. Dean. April 22nd, 1924. (230,656.)

11,495. "Apparatus for indicating low electric tensions." H. Wade (Naamlooze Vennootschap Philips Gloeilampenfabrieken). May 9th, 1924. (230,664.)

11,512. "Lighting arrangements or installations." O. P. Bernard. May 9th, 1924. (230,665.)

13,233. "Electric heaters." A. Straaser and O. Graber. June 6th, 1923. (217,212.)

13,262. "Electric circuit control apparatus." S. E. Grubb and D. Wallis. May 29th, 1924. (230,677.)

20,514. "Taping machines." Western Electric Co., Ltd. December 6th, 1923. (Addition to 203,297.) (225,816.)

21,303. "Protective devices for alternating-current systems." British Thomson-Houston Co., Ltd. (General Electric Co.). September 9th, 1924. (230,725.)

25,001. "Electrical switches." F. B. Cox. December 21st, 1923. (Divided application on 230,566.) (230,748.)

28,178. "Wireless receiving apparatus." T. F. Wilkinson & Co., Ltd., and P. Dansie. November 25th, 1924. (230,759.)

29,588. "Telephone exchange systems." Western Electric Co., Ltd. (G. Deakin). September 11th, 1923. (Divided application on 226,265.) (230,763.)

30,037. "Electric cables." Johnson & Phillips, Ltd., and D. A. S. Porteous. December 13th, 1924. (230,764.)

30,104. "Current-collector bows for electric vehicles." S. Sokal (C. Conradty [firm of]). December 15th, 1924. (230,765.)